THE RAILWAY GAZETTE
A Journal of Management, Engineering and Operation
INCORPORATING
Railway Engineer · TRANSPORT · The Railway News
The Railway Times · Herapath's Railway Journal · THE RAILWAY RECORD.
RAILWAYS ILLUSTRATED · ESTABLISHED 1835 · THE RAILWAY OFFICIAL GAZETTE

PUBLISHED EVERY FRIDAY
AT
33, TOTHILL STREET, WESTMINSTER, LONDON, S.W.1

Telegraphic Address: "TRAZETTE PARL., LONDON"
Telephone No.: WHITEHALL 9233 (6 lines)

Annual subscription payable in advance and postage free
British Isles and Abroad.....£2 5s. 0d.
Single Copies.....One Shilling
Registered at the General Post Office, London, as a Newspaper

VOL. 64. No. 8 FRIDAY, FEBRUARY 21, 1936

CONTENTS

	PAGE
Editorials	321
Letters to the Editor	327
Publications Received	328
The Scrap Heap	329
Overseas Railway Affairs	330
Bethnal Green—Enfield Colour-Light Signalling	333
New Speed Indicator and Recorder	340
A Modern Flanging Shop	343
Enamelled Coaches in India	344
New American 4-8-4 Type Locomotives	345
Sir William Forbes	346
Railway News Section	347
Personal	347
Contracts and Tenders	362
Official Notices	363
Railway Share Market	364

DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with each copy of this week's issue

Sir William Forbes

AN outstanding figure among pre-grouping general managers has passed from us with the death on Friday last of Lt.-Col. Sir William de Guise Forbes. The family connection with both railway service and courageous management is of long standing, for his famous uncle, James Staats Forbes, entered the service of the G.W.R. in 1838, and his father, Mr. William Forbes, was Manager of the Midland Great Western Railway of Ireland at the time Sir William was born in Dublin in 1856. James Staats Forbes began his eventful managership of the London Chatham & Dover Railway in 1861 and ten years later became Managing Director. William de Guise Forbes began his railway career under his uncle in the service of that railway in 1873, and ultimately, on the formation of the S.E. & C.R. in 1899, became Assistant General Manager of the combined system. Very shortly afterwards he accepted the offer to become General Manager of the L.B. & S.C.R., a position he occupied successfully during the notable period from 1899 until grouping in 1923. Almost as soon as he had assumed office, some former colleagues from the L.C. & D.R. invited his help in the formation of the Railway Convalescent Homes; he gladly agreed, subject only to the condition that the movement was not to be affected by social, political, or other influences, and became the first President of the institution. Sir William was an honoured guest at the family dinner of the institution on November 9 last, and, in proposing the toast of "The Homes," gave an interesting account of the early days. Lord Palmer, in responding, emphasised how much the institution owed in its early years to Sir William's help and said he regarded him as the "father of the convalescent homes." Sir William's work was as notable in the sphere of railway operation as it was in that of social and philanthropic work. During his regime the L.B. & S.C.R. opened (in 1900) the Quarry line between Coulsdon and Earlswood, giving the Brighton Company a line of its own independent of the South Eastern Railway section at Redhill. Sir William had not planned this line, but he speedily made effective use of it and in 1908 introduced The Southern Belle, which rapidly became one of the best known trains in the world. He also inaugurated the successful policy of suburban and main-line electrification, beginning with the conversion of the South London line on December 1, 1909, and from the first intended to include the main line to Brighton. These are but two outstanding events in a notable general managership, to which we refer in more detail on page 346.

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The Week's Traffics

In the traffics of the four group companies for the past week there is a net increase of only £8,000. Passenger train traffics are uniformly down, and the coal traffics of the Great Western and Southern also show small decreases. Merchandise traffics, on the other hand, are up except on the Southern. For the seven weeks of the year to date passenger train traffics show an increase of £47,000, merchandise receipts a net advance of £94,500, and coal class receipts an improvement of £312,500. Altogether, traffics of the four companies to date amount to £18,771,000, an increase of £454,000, or 2·48 per cent.

	7th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	%
	£	£	£	£	£	
L.M.S.R.	— 1,000	+ 5,000	+ 4,000	+ 8,000	+ 191,000	+ 2·57
L.N.E.R.	— 6,000	+ 8,000	+ 4,000	+ 6,000	+ 168,000	+ 3·03
G.W.R.	— 1,000	+ 1,000	— 3,000	— 3,000	+ 61,000	+ 1·99
S.R.	— 1,000	— 1,500	— 500	— 3,000	+ 34,000	+ 1·50

London Transport receipts for the 33 weeks of the current financial year amount to £17,916,300, an improvement of £315,400. On the Mersey Railway the traffic increase to date is £594.

* * * *

British Industrial Efficiency

Once more, on a scale even greater than before, the British Industries Fair exhibits to the world the accomplishments of industrial Britain. It reveals to the observant visitor year by year a marked advance in the efficiency of the British productive machine. It would be interesting, and the result would probably be surprising, if figures were prepared, taken from the exhibits at the fair, to show this advance. The latest electric furnace, compared with its predecessor, for example, doubtless makes possible certain performances at reduced energy consumption, and with such higher quality results as make for subsequent energy conservation. The advance in equipment, in the quality of materials, in methods and processes, are all noticeable at the British Industries Fair, and should be assessable in the form of an efficiency factor. How stimulating, and how beneficial to the country's morale, would be the annual publication of authentic figures showing this undoubted advance in British industrial efficiency.

Railway Carriage Seats

Not long ago, in the form of a leading article, we tried to place before our readers a true impression of the German railways today. We outlined their extraordinary progress in modernisation, a progress so well planned and scientifically controlled that, with an unprecedented real economy (*i.e.* an economy of energy expenditure) they now offer to the public a service markedly better than ever before. In respect of speed and punctuality the German State Railway can give us points, and, as to the comfort of its latest second class carriages, we commend the attention of our readers to the picture on page 342. Second class on the Continent is generally comparable in price with third class here (German standard third class fares are, on a parity basis, about ¾d. a mile), and we think that, despite the remarkable improvement in British third class accommodation of recent years, the Germans have done better, mainly in regard to the actual comfort of the seats. These, while very well sprung, give support to the average back where it most needs support, and are near enough to the floor to allow the feet to rest comfortably and squarely on it, without a suspicion of dangling (the most potent cause of that tired feeling).

* * * *

Speed and Comfort

The recent burst of train accelerations in America has been due not to a sudden access of increased locomotive power but to the completion on many sections of main line of extensive permanent way strengthening works, mainly in the form of improved drainage and ballasting and the realignment of curves, as well, of course, as the perfecting of the rail-top level. Before the speeding up which has taken place of recent years on the European Continent, a similar programme of permanent way improvement had to be undertaken. In Great Britain our general standard of permanent way had hitherto been higher than that prevailing in most other countries, and it has been possible to speed up many trains without any specific permanent way preparation. The call for faster travel has been so insistent of late, stimulated no doubt to some extent by the faster trains already provided, that there is apparently in some countries a danger of accelerations outstripping track capacity. We read in a Dominion newspaper recently the following alarming passage: "Passengers by the fastest expresses are thankful to arrive at their destination, for sleep is practically an impossibility, and passengers are tossed and bumped and rolled about in their berths, occasionally finishing on the floor." This is probably exaggerated, but it suggests that schedules in the country referred to are surpassing the preparations made for their comfortable maintenance.

* * * *

Heroism of Railway Servants

The railway record of safety is due to the fact that conditions of emergency so rarely develop—a striking contrast to the roads, where emergencies may be met with at any unprotected street corner. Sometimes, however, circumstances create situations in which the working of the system must be replaced by personal initiative, and there must be countless unrecorded occasions on which railwaymen have shown themselves as well able to deal with out-of-course crises as to observe their routine responsibilities. To afford tangible recognition of heroism displayed in such moments, the Pennsylvania Railroad in 1923 instituted two heroic service medals, ninety-eight of which have now been awarded since that date. The latest awards were made last month, the recipients being R. A. Mason, an oiler on the company's steamer *Virginia Lee*, engaged in the Cape Charles-Norfolk service, and Joseph Mustafa, a crossing watchman on the Long Island Railroad. Mason, although a poor swimmer, dived into the harbour at Cape Charles and rescued a boy who had fallen from his bicycle while attempting to ride ashore along the gangplank. The crossing keeper, Mustafa, saved a nine-year old girl who stepped from behind a passing train into the path of one approaching from the opposite direction, after he had warned her to wait until both trains had passed. Mustafa snatched the girl directly from the path of the train, which missed them by only a few inches. The crossing was protected by flashing lights and bells.

* * * *

American Railways versus the Calendar

Again the wall calendar issued by the Committee on Public Relations of the Eastern Railroads (U.S.A.) shows the amount by which, at average daily receipts, the year is too short for the Class I railways to cover their interest obligations. In 1934, the latest year for which the Bureau of Economics of the Association of American Railroads has complete data, wages alone absorbed the equivalent of 161 day's receipts; fuel, materials and supplies, and other operating expenses represented the proceeds of working for 112 days, and taxes accounted for the revenue of 27 days. Thus, 1934 being a leap year, 66 days were left for earning interest and fixed charges, which actually required 83 days for their full service. A leaflet which has reached us together with a copy of the calendar shows the net result of working in 1934 on the Class I railways to have been a deficit of $150,305,974, and a footnote adds: "leaving nothing available for investment in new railroad facilities—or for making up deficiencies incurred in previous years, or to help create reserves against bad years in the future." Copies of the calendar are being displayed at many stations, and it is to be hoped that as its story becomes familiar by annual repetition, it will not be regarded as an attempt to gain sympathy for the railway industry, but will drive home the seriousness of the situation when distributive facilities upon which future well-being must depend have to be allowed to stagnate.

* * * *

Fleiverkehr

Recently there has appeared in the *Bulletin of the Hamburg World Economic Archives* a description of the steps that have been taken to co-ordinate rail and air transport in Germany and provide an express service for small freight consignments. This *Fleiverkehr* service, as it is called, is not confined to the State Railway, its associated express road services, and the German Airways (Deutsche Luft Hansa), but also involves co-operation with thirteen foreign air operators such as Imperial Airways, Air France, and the Sabena of Belgium. Parcels for transit under the scheme may be handed in at any air or railway office for despatch to all parts of the Continent, and also North America via the catapult service of the Norddeutscher Lloyd Atlantic liners *Europa* and *Bremen*. The packages, which are limited to 100 kg. in weight, are given preferential consideration, and in the case of international transport the usual Customs regulations apply. Immediately on arrival of the goods, the consignee is notified by telephone or express postcard, and delivery can then be made to the consignee if required for a small charge. Normally the goods are cleared by the Customs and received within one or two hours of arrival.

* * * *

Class Distinctions

The writer of an article in our American contemporary, the *Railway Age*, summarising impressions gathered while travelling recently in Great Britain, has some interesting

things to say concerning the relative treatment of passengers of different classes in the two countries. "Accommodations for third class passengers, except in suburban service," he writes of British travel, "are just about as comfortable as first class. The principal—one could almost say the only—advantage of first class is a lower percentage of occupancy. There is no feeling of inferiority in any respect attached to third class travel in Britain. Railway employees—porters included—are as solicitous for the comfort of the third class traveller as for the one travelling first. By contrast, and speaking from experience, the passenger with the cheaper accommodations in this country"—the writer now refers to the United States—"is occasionally made to feel ill at ease, and as though he, somehow, were being tolerated rather than really welcomed." Reverting to Great Britain, the commentary continues "All employees encountered were uniformly courteous, but not more markedly so than would be found on the American railways. The tipping practice appears to be more widespread on the British railways, but, on the other hand, the courtesy and efficiency of the service did not appear to fluctuate in proportion to the employee's estimate of what the tip would be." It is probably true that in no other country in the world is railway travel more truly democratic in its characteristics than in Great Britain.

* * * *

Metadyne Control on the Underground

It is not impossible that the metadyne system of control, which the London Passenger Transport Board has specified for use on the new trains for the Hammersmith to Barking service, will be ranked with the mercury arc rectifier as the two most important post-war developments in d.c. electric traction. The system has been given a long apprenticeship, for in addition to a trial train which has been running on the London Underground for over a year, there has been an experimental application in France extending over a number of years. The system has been developed in this country by the Metropolitan-Vickers Electrical Co. Ltd. from the invention of Mr. G. M. Pestarini. Its principal features are rapid and smooth acceleration and deceleration, by the elimination of starting resistances which necessitate the acceleration being made in a number of jerks as each bank of resistances is cut out, and by the provision of an automatic regenerative braking system which operates on the motor axles of the train. The normal electro-pneumatic brake is being fitted, and the driver will be able to use either or both systems at will, the regenerative principle being effective to a speed as low as 4 m.p.h., a startling characteristic compared with the regenerative brakes fitted to main line electric trains. The action of the combined brakes will give a retardation of 3 m.p.h. p.s., and with a notchless acceleration of 2 m.p.h. p.s. in normal working (compared with 1·0 to 1·3 m.p.h. p.s. at present) it should be possible to increase once again the traffic capacity of London's electric railways, and just at a time when it was thought that the absolute capacity had been reached.

* * * *

The Brussels Junction Line

At the time of the Belgian Railway Centenary last year we pointed out that the Belgian system was unusual in having been planned on national lines, instead of growing in the piecemeal and somewhat haphazard way of other countries. It is therefore not surprising that a junction line through Brussels should have been considered as long ago as 1836. On May 4 of that year the original Brussels-Malines line was extended to Antwerp and a railway from the south of Brussels to Mons and the French frontier was taken in hand; it was opened to Hal in 1840, to Mons in 1841, and to the frontier at Quievrain in 1842. After many proposals, counter proposals, and endless discussion, the scheme was shelved until shortly before the war, when work was actually begun at the Midi end. It was abandoned in August, 1914, by which time the works, some 21 ft. above street level, had been carried as far as the Rue du Poincon. Now the Nord-Midi line is being taken in hand actively, and on page 358 we give brief details of the way in which the railway is to be financed and worked, and the alignment adopted.

* * * *

Resignalling an L.N.E.R. Dense Traffic Area

Elsewhere in this issue we publish a description of the latest colour-light signalling installation in the Southern Area of the London & North Eastern Railway. It is of particular interest in that part of the 9½ route miles of line resignalled carries some of the densest passenger traffic in the country, with a 1¾-min. headway between trains in rush hours, and a peak traffic of as many as 58 up and down trains passing Hackney Downs signal box in the busiest hour. The value of the new signalling is therefore very considerable from the operating point of view, and economically, too, the elimination of 17 signal boxes and the additional safety provided by the automatic signals are most important. As a substitute for the old splitting distant signals on the Clapton approach to Hackney Downs, a special colour-light in combination with two route indicators is used, the first of its kind in this country. The double yellow aspect here and in other signals is secured by the neat expedient of superimposing an optical yellow lens unit upon the standard searchlight unit, the former automatically aligned parallel to the latter. These features are specialities of the firm that supplied and installed the whole equipment, the Westinghouse Brake & Signal Co. Ltd., and both the L.N.E.R. and this firm are to be congratulated on the successful design and carrying out of so complicated a scheme in difficult circumstances.

* * * *

Locomotives Designed by Foremen

A correspondent of our American contemporary, the *Railway Mechanical Engineer*, suggests that, as so many complaints are voiced by foremen at locomotive depots, a useful purpose might be served, or at least some enlightenment obtained, by inviting them to collaborate with those at present responsible for the design of the engines. The idea would be to supply each foreman with a questionnaire on which he would be requested to enter details of the faults with which he most frequently had to deal, and to state how, in his opinion, these could, by redesigning the offending parts, be mitigated or overcome. The questionnaire, whilst covering all details of the locomotive, would apply in particular to fittings and accessories, rather than to the heavier components associated in greater measure with the fundamental basis of the design. This would doubtless let loose a flood of pet ideas, many of them more or less conflicting. No longer would the boiler leak at any point or the cylinder cocks refuse to function. No more sticking injectors or faulty gauges, whilst useful fittings, known in the language of the running shed as "gadgets," would henceforth carry out their allotted tasks without let or hindrance, and all locomotives would be on time. But, asks the correspondent, when all the tabulated data had been considered and some of it, perchance, adopted, "do you think the darned thing would run?"

Great Western Railway

APART from parcels and from exports of coal from South Wales, the business of this company showed a general expansion during 1935 in comparison with the previous year and the gross receipts of £25,738,314 from the railway advanced by £448,635 or 1·77 per cent. In the railway expenditure of £20,760,062 there was at the same time an increase of £409,587 or 2·01 per cent., causing a rise in the operating ratio from 80·47 per cent. to 80·66 per cent., so that the net railway receipts improved by £39,098. Ancillary businesses on the whole did not do so well as in the previous year, mainly on account of the fall of £42,210 in the net receipts from docks, harbours, and wharves, although steamboat net receipts improved by £11,264 and the profits from the hotels, &c., department by £3,118. Gross receipts from road transport goods services were £71,852, an improvement of £4,290, but net receipts were £4,721 lower. On air transport the loss was increased by £1,785. In the aggregate there was a net loss of £7,235 on ancillary businesses, comparing with a profit of £29,848 for the preceding year. It is shown in the report that the increase in the expenditure on the railway and in the ancillary businesses is almost entirely accounted for by the partial restoration in October, 1934, and January, 1935, of the percentage deduction from salaries and wages, and by additional running and maintenance costs attributable to the greater mileage run to meet traffic requirements. From "J" Joint Lines the company received £10,469 more net than in 1934, and from other miscellaneous net receipts £34,538 more, this last mentioned improvement being due to the fact that the dividends from associated omnibus undertakings rose from £121,570 to £153,208, and Carter Patersons and Hay's Wharf profits from £24,132 to £26,455. Net revenue for the year was £39,560 higher. Results for the past three years are compared in the accompanying table:—

	1935 £	1934 £	1933 £
Total expenditure on capital account	184,072,637	183,685,192	182,504,569
Gross receipts from businesses carried on by the company	29,788,622	29,280,382	28,423,656
Revenue expenditure on ditto	24,817,604	24,311,381	23,970,743
Net receipts of ditto	4,971,018	4,969,001	4,452,913
"J" Joint Lines—company's proportion of net revenue	141,107	130,638	131,779
Miscellaneous receipts (net)	1,114,271	1,069,264	985,331
Miscellaneous charges	775,837	757,904	741,462
Net revenue	5,450,559	5,410,999	4,828,561
Profit on realisation of investments	122,990	323,948	71,529
Interest on loans and debenture stocks	1,649,811	1,649,809	1,619,809
Dividends on rent charge, guaranteed and preference stocks	3,344,699	3,344,699	3,344,699
Balance after payment of preference dividends	579,039	740,439	Dr. 64,418
Dividend on ordinary stock	1,287,892	1,287,892	1,287,892
Rate per cent.	3	3	3
Deficit	708,853	547,453	1,352,310
Appropriation from contingency fund	710,000	550,000	1,350,000
Balance brought forward from previous year	43,226	40,679	42,989
Balance carried forward to subsequent year	44,373	43,226	40,679

Except for a decrease of £4,083 in first class season ticket receipts there was a general improvement in passenger travel. First class ordinary receipts advanced by £40,032, or 9·5 per cent., and first class receipts as a whole represented 7·15 per cent. of the total receipts from passengers as compared with 6·88 per cent. in 1934. Third class ordinary passenger receipts, apart from workmen, improved by £170,585, or 2·72 per cent., and third class season tickets by £1,515. Receipts from parcels, mails, and parcels post showed, however, a decrease of £68,043, or 2·29 per cent. Rates for the conveyance of this class of traffic had to be reduced concurrently with the concessions made by the Postmaster General in July last. From higher class merchandise the receipts were £7,048,841, an increase of £163,412, or 2·37 per cent., with an advance of 2·14 per cent. in the originating tonnage. Minerals and merchandise (classes 1-6) brought in £2,228,813, a gain of £7,115, or 0·32 per cent., with a decrease in originating tonnage of 0·27 per cent. Coal, &c., receipts were £5,279,986, an improvement of £87,748, or 1·69 per cent., with an increase of 0·21 per cent. in originating tonnage. Goods train receipts as a whole were £14,794,162, an increase of £293,777, or 2·03 per cent. The accompanying table shows the approximate allocation of receipts in 1935:—

	Amount £	Amount per £ s. d.
Salaries and wages	16,600,000	11 2
Coal	1,800,000	1 3
Other material	3,250,000	2 2
Rates and sundry items, *less* miscellaneous receipts	2,700,000	1 10
	24,350,000	16 5
Appropriation from reserves, &c.	850,000	0 7
	23,500,000	15 10
Interest and dividends on capital	6,250,000	4 2
	£29,750,000	20 0

In 1934 salaries and wages got 11s. 1d. in the £, whereas interest and dividends received 4s. 3d. with the aid of 7d. from reserves, &c. In train-miles there was an increase of 3·23 per cent. under coaching and of 1·66 per cent. under goods. In all the circumstances an increase of £92,263 in locomotive running expenses and of £110,025 in traffic expenses shows no lack of economical operation. The charge against maintenance of way and works was £82,434 more, and the length of track renewed was 270¾ miles, against 265½ miles in 1934. Renewals of locomotives in the company's shops were 122. For maintenance of rolling stock the sum charged in the accounts is £3,172,185, an increase of £36,613.

The balance sheet continues to show a strong financial position. Investments in Government securities total £8,177,538. The expected saving in rates in consequence of the House of Lords decision in the Southern Railway rating case does not appear in the accounts, but the directors anticipate a large reduction in the assessments and the recovery of substantial sums in respect of over payments. The remainder of the works undertaken by the company under the Development (Loan Guarantees and Grants) Act, 1929, are now completed, and the improved facilities have been of considerable benefit. Reference is made to the new works to be undertaken under the London Passenger Transport (Agreement) Act, 1935, and the Railways (Agreement) Act, 1935. Capital expenditure during 1935 amounted to £387,446 net, and included £14,700 on 3 diesel railcars. Estimated further expenditure in 1936, exclusive of expenditure under the 1935 Agreement Acts, is £794,000, including £42,000 for additional diesel railcars and £375,000 for subscriptions to road transport companies.

Southern Railway

ALTHOUGH the figures are not yet finally adjusted, the recent decision of the House of Lords that the Railway and Canal Commission had made the company's valuation for rating on the right principle has amply justified the directors in estimating a reduction of £246,077 in the sums payable for rates for the year 1935. From railway working there was an increase of £278,783, and allowing for the estimated reduction in rating payments, working expenses advanced by only £22,699. Apart from the savings in rates working expenses were therefore greater by £268,776. Railway net receipts (£4,554,499), allowing for the saving under rates, showed an improvement of £256,084. Net receipts from ancillary businesses as a whole were £486,127, an advance of £31,168 on 1934. Steamer net receipts were £14,994 lower, but dock receipts were £38,665 up and the 1934 loss of £3,349 on the three hotels which the company works, namely Deal (South Eastern, Charing Cross, and Craven, has been turned into a profit of £5,735. Road transport goods services earned £23,263 gross and £6,836 net, an improvement of £545, and there was an increase of £2,068 in the profit on collection and delivery of parcels and goods. The loss on air transport was, however, increased by £4,218, although the gross receipts were £1,196 against £272. The share of loss on the Somerset & Dorset joint line was reduced from £49,432 to £41,383, but miscellaneous net receipts were £15,570 lower, mainly because of the drop in general interest. Dividends of £26,451 (against £24,127) were received from the company's investment in Carter Patersons and Hay's Wharf. Miscellaneous charges are up £7,769, and the net revenue for the year is £271,962 higher. Results are compared in the accompanying table:—

	1935	1934	1933
	£	£	£
Total expenditure on capital account	167,425,314	166,064,274	164,336,509
Gross receipts from businesses carried on by the company	23,517,026	23,152,749	22,598,417
Revenue expenditure on ditto	18,476,400	18,399,375	18,092,686
Net receipts of ditto	5,040,626	4,753,374	4,505,731
"J" Joint Lines—company's proportion of net revenue	Dr. 41,383	Dr. 49,432	Dr. 45,706
Miscellaneous receipts (net)	1,310,909	1,326,479	1,302,368
Miscellaneous charges	237,855	230,086	222,596
Net revenue	6,072,297	5,800,335	5,539,797
Interest on loans and debenture stocks, &c.	1,943,167	1,943,167	1,943,167
Dividends on guaranteed and preference stocks	2,751,278	2,751,278	2,751,278
Balance after payment of preference dividends	1,377,852	1,105,890	845,352
Dividend on preferred ordinary stock	1,379,330	1,103,464	827,598
Rate per cent.	5	4	3
Surplus or deficit, + or −	− 1,478	+ 2,426	+ 17,754
Balance brought forward from previous year	227,353	224,927	207,173
Balance carried forward to subsequent year	225,875	227,353	224,927

Passenger train traffic produced £15,626,365, or £462,115 more than in 1934. Passengers brought in £13,387,486, an improvement of £470,265, or 3·64 per cent. First class represented 1·78 per cent. of the total of ordinary passengers (including workmen), and produced 7·89 per cent. of ordinary passenger receipts, but, including season tickets, first class brought in 10·24 per cent. of the total passenger revenue. First class ordinary receipts improved by £47,915, or 6·19 per cent., and second class boat train passengers yielded £3,449 more. In parcels, mails, &c., there was a decrease of £8,151. Goods train receipts amounted to £4,782,762, a decrease of £184,914, or 3·72 per cent., although only 220,050 tons less were carried. Higher class merchandise receipts were £101,839 less, with a decrease of 97,178 in tonnage. For the railway the operating ratio was reduced from 78·90 per cent. to 77·94 per cent. Maintenance of way and works cost £137,557 more, and maintenance of rolling stock £68,319 more. Locomotive running expenses increased by £58,550, and traffic expenses by £7,806. The length of track renewed was 169 miles, against 175 miles, and the number of locomotives renewed in the company's shops was 16, compared with 8 in 1934. Carriage renewals were 181, against 150. Steam engine miles run by the company's engines were 1,504,646 less, but electric engine miles increased by 2,441,841. Capital expenditure during the year amounted to £1,361,040 net, of which the chief items were £622,084 on electrification, £337,182 on stations, signalling, &c., and £328,055 on Southampton docks extension—second stage. The widening between Southampton Central and Millbrook has been completed. Passenger service on the Chichester and Midhurst line has been withdrawn, but the line is kept open for goods traffic. Good progress is being made with the construction of the new dock at Dover for the train ferry service.

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London Midland & Scottish Railway

SHAREHOLDERS will have every reason to be satisfied with the results shown by the report of this company for the year 1935. Even if the large estimated reduction on account of rating had not been made, over 2 per cent. would have been earned on the 4 per cent. preference stock, 1923, whereas with the saving on rates the full 4 per cent. is being paid with £113,972 to spare. Gross receipts from railway working amounted to £61,658,170, an increase of £1,086,583, or 1·79 per cent., and in the railway working expenses of £49,521,464 there was a reduction of £41,747 after crediting £850,000, which is transferred to rates and rate relief suspense account. The operating ratio therefore comes down from 81·83 per cent. to 80·32 per cent. Some 10,109,577 more passengers (including season ticket holders) and 1,420,135 more tons of goods traffic were carried, and locomotive running expenses increased by £128,756 and traffic expenses by £156,268. Under locomotive running there was an increase of £130,652 in salaries and wages largely due no doubt to the partial restoration of cuts, and similar reasons have affected the rise of £169,684 in salaries and wages under traffic expenses. To maintenance of way and works £168,447 more was charged, and to maintenance of rolling stock £115,304 more. General charges have advanced by £202,277 mainly on account of superannuation and benevolent funds and pensions, and there has also been an increase of £10,573 in salaries, although directors' fees have been reduced from £26,250 to £25,000.

Net railway receipts were £12,136,706, an improvement of £1,128,330. From ancillary businesses the profits were £274,904 net, an increase of £27,517 on 1934. In road transport there was an improvement of £694, steamboats gave £31,875 more, docks, harbours and wharves £29,194 more, and hotels, refreshment rooms and cars £16,442 more. On the other hand the loss on collection and delivery of parcels and goods has been increased by £12,439, and that on air transport by £20,032, although the gross receipts from air transport were £9,722 higher, at £12,626. Net revenue from "J" Joint lines improved by £11,008. Among the miscellaneous receipts the dividends from omnibus undertakings advanced from £230,197 to £242,786, the income from the Carter Paterson and Hay's Wharf undertakings from £24,142 to £26,466, and

from Joseph Nall & Co. Ltd. and Wordie & Co. Ltd. from £4,500 to £7,439. From David McBrayne Limited the income was unchanged at £6,875. The loss on the Northern Counties Railway (Ireland) was reduced from £38,425 to £16,506, but general interest receipts were £85,239 lower. The accompanying table shows the general financial position compared with the two preceding years:—

	1935	1934	1933
	£	£	£
Total expenditure on capital account	452,843,092	452,554,778	452,974,229
Gross receipts from businesses carried on by the company	69,455,245	68,180,325	65,291,119
Revenue expenditure on ditto	57,043,635	56,924,562	55,185,091
Net receipts of ditto	12,411,610	11,255,763	10,106,028
"J" Joint Lines—company's proportion of net revenue	68,314	57,306	53,974
Miscellaneous receipts (net)	2,291,005	2,331,358	2,266,839
Miscellaneous charges	1,743,404	1,723,191	1,714,156
Net revenue	13,027,525	11,921,236	10,712,685
Interest on debenture stocks	4,439,171	4,439,171	4,439,171
Dividends on guaranteed and preference stocks	8,474,382	7,521,200	6,213,860
Balance after payment of preference dividends	113,972	*Dr.* 39,135	59,654
Balance brought forward	20,519	59,654	—
Balance carried forward	134,491	20,519	59,654

Receipts from railway passengers in 1935 totalled £18,632,658, an increase of £425,937, or 2·34 per cent. First class ordinary passengers brought in £1,162,885, an increase of £64,675, or 5·89 per cent., and although there was a decrease of £53,409 in first class season ticket revenue, the aggregate first class receipts of £1,688,410 represented 9·05 per cent. of the total receipts from passengers. There was, however, a decrease of £23,526 in the receipts from parcels, mails, &c. The reduction in parcel post rates made by the Government from July 1 last, forced a consequential reduction in railway rates for small parcels by passenger train. Receipts from higher class merchandise were £17,513,346, an increase of £192,925, or 1·11 per cent. and the average receipt per ton rose from 13s. 1·84d. to 13s. 2·23d. Minerals and merchandise (Classes 1-6) brought in £5,498,158, an improvement of £189,936, or 3·58 per cent., accompanied by an advance from 4s. 1·19d. to 4s. 2·46d. in the average receipt per ton. There was also an increase from 3s. 4·03d. to 3s. 4·47d. in the average receipt per ton from coal class traffic, which brought in £12,327,875, an improvement of £288,633, or 2·40 per cent.

* * * *

America's Speed Advance

CERTAIN features of outstanding interest are presented by the American railway speed statistics which appear on page 350 of this issue. As the writer of the article points out, the advance that has been made in speed in the United States in the brief period of five years is without parallel in any other country in the world. From 29 runs, totalling 1,106 miles, which at the end of 1930 were timed over American metals at 60 m.p.h. and more, the number at the end of 1935 had expanded to 413, with a total mileage of 19,279. Not only so, but the United States has now earned the distinction of including in its timetables the eight fastest start-to-stop runs in the world that are performed by steam power. This list, remarkable to relate, is headed by a railway which, so far as its steam locomotives are concerned, makes no use of streamlining or other aids to sustained high speed, but relies on ordinary Pacifics and ordinary rolling stock for these daily feats. This is the Pennsylvania, whose two fastest runs are timed at 75·6 and 75·4 m.p.h. from start-to-stop. Next in order, with steam power, comes the Hiawatha of the Chicago, Milwaukee, St. Paul and Pacific, which has one start-to-stop schedule at 73·9 m.p.h. But the two-way pass-to-pass booking of the Hiawatha over 41·5 miles of line between Chicago and Milwaukee outside the area of restricted speed required within the suburbs of those two cities, at 88·9 m.p.h., is probably a world's record at the present moment for speed on rails with steam; over this section maximum speeds up to and slightly exceeding 100 m.p.h. are not unusual with this train.

Further, the Pennsylvania is not content merely with steam speed supremacy. In October last the whole of its timetables over the electrified lines between New York, Philadelphia, Baltimore, and Washington were completely overhauled, and every express train was brought up to a mile-a-minute standard, or more, between stops. As a result, 135 runs are made daily by electrically-hauled trains over Pennsylvania metals at start-to-stop speeds of from 60 to 69 m.p.h. The total mileage of 5,794 so involved is alone greater than that of all the runs made by British railways at 60 m.p.h. and over. With steam and electricity combined, the Pennsylvania can show 171 runs daily at over a mile-a-minute, aggregating 8,359 miles—a wonderful record for a railway whose total route mileage is 10,892, but of which only the extreme ends, along the eastern Atlantic seaboard and west of Crestline, are adapted to high speed running, owing to the intervening obstacles of the Allegheny Mountains. Not only so, but weighty express trains such as the Broadway Limited figure in both the steam and electric achievements. The two fastest electrically-hauled journeys in America, however, are to the credit of the Chicago, North Shore & Milwaukee—an inter-urban railway whose access to both Chicago and Milwaukee is over street tramways, but which intermediately has developed the fastest service of its kind in the world, with 90 daily runs, none of them over 27 miles long, booked at 60 m.p.h. and upwards, and the quickest at 75 m.p.h.

Diesel competition in America is as yet in its infancy, though it has made considerable strides in a short time, and already can show 42 runs, with a total length of 2,339 miles booked at 60 m.p.h. and more. The respective totals at over a mile-a-minute in the United States are thus 9,469 miles by steam, 7,471 miles by electricity, and 2,339 miles by diesel power. Eighteen runs in all are booked at over 70 m.p.h. from start-to-stop, totalling 935 miles, and of these twelve are steam-hauled, two are electric, and four are diesel-propelled. Thirteen of the runs are faster than the quickest British start-to-stop journey—the 71·4 m.p.h. of the G.W.R. Cheltenham Flyer. Among long-distance expresses, the Twentieth Century Limited of the New York Central is booked over the 819 miles from Chicago to Albany at 60·6 m.p.h. throughout, all stops and speed restrictions included. It is important to note, also, that the American timings reviewed in this issue do not exist merely on paper, for American railways are justifiably proud of their punctuality records. One detail in which their long-distance schedules differ from those of our own country is in their tendency to ease out the timings over the last stage of a long run, in order to afford some margin of time recovery to ensure a punctual arrival in all conditions, for recovery of lost time in the United States is not a matter of option for the driver. "If an engineer don't make up time," said an American operating officer once, "why, he goes off the job."

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Summer Locomotive Work in France

58, Rue de Courcelles, Paris.
February 2

To the Editor of The Railway Gazette

Sir,—I have read with interest Mr. C. J. Allen's letter and the answer thereto appearing on page 194 of The Railway Gazette of January 31. I think the question would be made quite clear by quoting an example—for instance Tr. 3 from St. Pierre to Bordeaux (Benauge):—

Running time 4 hr. 15 min.; time gained per run, average for July, 1935, 10 min.; actual running time 4 hr. 05 min.; number of stops 7; time lost through starting and stopping.

As observed in *normal* practice (with maximum cut-off 50 per cent.) and 700-ton loads: Starting = 3¾ min. Stopping = 1 min. These figures are high because:—

(*a*) the starts are nearly all on short gradients 1 in 500 to 1 in 200, and generally on a curve.

(*b*) the great length of the trains requires caution to be exercised when stopping.

For the whole trip, with eight start to stop runs, the total time lost is 38 min. In July, 1935, the running time at full speed was therefore 4 hr. 5 min. less 38 min. = 3 hr. 27 min. The distance from St. Pierre to Bordeaux (Benauge) is 215·3 miles, so the average full running speed works out at 62·4 m.p.h. This is an average figure. Certain sections call for harder work. With the rigidly enforced limitation to 74·6 m.p.h. the average speed downhill is something like 70-72, and with a normal rate of 65 m.p.h. on the level, there is enough justification for speeds of 50 to 60 m.p.h. up most gradients of 1 in 200.

The average weight of Train 3 in July, 1935, was 705 tonnes.

Yours truly,

BN. G. VUILLET

[We are glad to have this elucidation from Baron Vuillet, which tends to justify the contention that speeds of 50 to 60 m.p.h. are normally called for up gradients of 1 in 200 with the heavier trains on the P.O.-Midi Railway. The method by which Baron Vuillet demonstrates this is ingenious, but we think convincing. He has assumed a run, with a flying start and a flying finish and no intermediate stops, would be made at an average running speed of 62·4 m.p.h., and from our own observation his allowance for starting and stopping appears to be reasonable.

With regard to the average time lost (and subsequently regained) per run—ten minutes—during July, this does not seem unreasonable for seven intermediate stops, some of which, with very long trains, require a double pull up, and at many of which the business is so heavy as to take longer than the time allowed.—Ed. *R.G.*]

14, Square Desaix, XVe.
Paris, February 7

To the Editor of The Railway Gazette

Sir,—I have read with interest Mr. Allen's letter in your issue of January 31. The following table gives the average weights of some of the principal Paris-Bordeaux trains during last summer.

Train	July	August	September	Maximum Weight
	Metric tons	Metric tons	Metric tons	Metric tons
3	705	603	636	803
12	—	682	683	741

These trains, comprising 14 to 18 cars, consistently exceeded their station allowances, double stops at certain stations being necessary, and regained on an average 10-12 min. on the run from St. Pierre to Bordeaux.

The starts on the Paris-Bordeaux line are systematically uphill, for all important towns are on small rivers running transversely to the direction of the line, and the time taken to gain the normal running speed is therefore increased. The speed limit of 120 km.p.h. calls for fast uphill work. With a heavy train a run of, say, 25 miles start to stop in 29-30 min. calls for a running speed of about 65 m.p.h.

Yours truly,

DANIEL CAIRE

Jubilee of the Mersey Railway

London, W.C.1.
February 8

To the Editor of The Railway Gazette

Sir,—I was interested to see in the article on the above subject, published on pages 207-9 of your issue of January 31, that you made reference to the Mersey tunnel scheme which was contemplated in 1825, and quoted from a contemporary newspaper of that period. It is not generally appreciated that the scheme continued to be discussed for some years not only in relation to the proposed Birmingham-Birkenhead railway, but also in its bearing upon the Liverpool & Manchester Railway then under construction.

Charles Blackner Vignoles, who had acted as Resident Engineer to the Liverpool & Manchester Railway, resigned his appointment on February 2, 1827, following disagreement with George Stephenson, but remained in Liverpool for a short time examining various projects then under consideration, including the Mersey tunnel scheme. In a letter published in the Liverpool *Albion* in March, 1827, he stated that "A few opulent inhabitants are already associated for a project which would formerly have been thought chimerical—viz., a tunnel under the Mersey from the Cheshire shore to Liverpool." In connection with certain fears which had been expressed as to the safety of such works, Vignoles cited his experience with the tunnel on the Liverpool & Manchester line, saying "When it was first broached by the late engineers of the railway (the Rennies), it was received with distrust even by the directors; and when the intention became public, with alternate feelings of ridicule and fear by the inhabitants at large. The waterworks talked of their supplies being cut off, and learned counsel employed against the Bill seemed to suppose that all the wells in Liverpool would be tapped, and that the water would filtrate diagonally into the tunnel! How groundless all the outcries of the alarmists have proved is demonstrated by the operations now in hand. But I would especially refer to the tunnel under the Thames, at present advancing with rapidity and success under the able management of that eminent engineer, Brunel."

Vignoles then sketched the probable cost of the proposed Mersey tunnel, and of the revenue it was likely to produce, but as you recorded in your article on the Jubilee of the Mersey Railway, the scheme was not realised. Its existence shows clearly that the advantages of such a means of communication were many and strong, and the attitude of Vignoles to the proposal is but one of many evidences of the professional foresight which was one of his characteristics.

May I add that in connection with the Mersey tunnel scheme, James Mawdsley, then a well-known citizen of Liverpool, wrote to Vignoles in the following terms: "In the event of the plan receiving a tangible shape, I feel sanguine that there will be no one so likely to be connected with it as yourslf. Your success with the Liverpool & Manchester Railway (which would never have been a railway but for you) puts this beyond all doubt."

Yours faithfully,

JOHN WELLINGTON WELLS

PUBLICATIONS RECEIVED

Walking and Cycling Tours in the Manchester District. London: London & North Eastern Railway. 7¼ in. × 4¾ in. 136 pp. Illustrated. Folded maps. Paper covers. Price 6d. net.—Touring in the Manchester district, whether on foot or cycle, is often, to say the least, an arduous pastime. But it is the very ups and downs that have to be negotiated from which the country derives its stimulating character. This little book, however, should do much to help to mitigate the possibilities of incurring unnecessary fatigue and add to the joys of exploring the Peak district. No fewer than 139 suggested itineraries are described and illustrated, and 18 specially prepared maps supplement the text. The compiler has that happy knack of directing the tourist along his route, without his realising it, by imparting the next instruction while drawing attention to some item of topographical interest. Thus the guide is neither a series of wearisome directions nor a succession of exhortations to observe. The L.N.E.R. has issued in connection with this booklet an attractive poster depicting in colour a typical Derbyshire river scene.

Rambles in Cambridgeshire. By Bernard Reeves. London: The London & North Eastern Railway. 7¼ in. × 4¾ in. 99 pp. + folding map. Price 6d. net.—This is the thirteenth volume in the series of "Rambles" books published by the L.N.E.R., and it covers the area bounded roughly by Audley End, Royston, Caxton, St. Ives, Ely, Mildenhall, Bury St. Edmunds, and Haverhill. It does not claim to be a guide book—Cambridge is dismissed in the preface and ramblers are warned that if they try to include Ely Cathedral in the day's walk they will probably fail to reach the railway station before nightfall—but instead it covers the district by fourteen rambles and is confined to points of interest concerning what is seen during the walks. The rambles vary from 11 to 21 miles, and the description of each (apart from the route directions) usually takes about three pages, so is necessarily limited, but is sufficient for the great majority of ramblers. Main roads are avoided as far as possible, the byways and footpaths being preferred. Parts of several of the walks are along the banks of streams or by the dikes of the Fen district, and on page 50, devoted to describing the attempts to drain the marshy land, the reference to the digging of the New Bedford River is evidently meant for the earlier scheme—the Old Bedford River.

There is a large number of excellent pen-and-ink sketches in addition to a coloured view of Ely Cathedral on the cover, and the routes of the rambles are shown by clear maps. These sketches and maps, together with the use of Gill type throughout the text, give the book a very attractive appearance, and the volume will be found of great use and interest to ramblers in any part of the district covered, whether they are exploring the higher lands of the south-west or the marshy fens of the Isle of Ely.

The South American Handbook, 1936. London: Trade & Travel Publications Limited, 14, Leadenhall Street, E.C.3. 7 in. × 4½ in. 633 pp. Folding map. Price 2s. 6d. net.—Latin-America is still in process of rapid transformation, as new roads, additional air services, rail routes, hotels, and even ports are being added year by year. *The South American Handbook*, of which the thirteenth annual edition is now before us, succeeds in coping with these changes and in providing the most up-to-date information available. The intensive work put into the preparation of the present edition is shown by the fact that there are few paragraphs in it which have not undergone some change from the previous edition. Details of railway, steamship, and air services are liberally given, with maps of the principal railway systems, and a coloured folding map of all the countries surveyed, from Mexico southwards to Tierra del Fuego. Business men will find their wants attended to by details about the main towns, physical features, governments, products and trade, and travellers for pleasure have ample information, given in a concise and readable form, and for all classes of traveller the hints as to hotels, tipping, diet, clothing suitable for different temperatures, and a list of Spanish and Portuguese terms will be invaluable. A feature of particular interest to us is the information as to times and frequency of express services between some of the important towns. First-class travel by rail is strongly recommended in preference to second. In Peru, apparently, there is also an intermediate class.

Radial Drilling Machine.—The Asquith L. D. type radial drilling and tapping machine described in this catalogue, from William Asquith Limited, Halifax, is designed to combine real high speed production with easy and rapid handling. It can be supplied either with belt or motor drive, a single motor in the latter case controlling both drive and elevating motion. Prominent features of the general specification are the high quality of workmanship and materials, and the range of speeds available from the self-acting feed gearbox. A new form of speed selector is included, in which a disc is turned until the class of material to be drilled comes into view, when the appropriate speed is automatically engaged after a similar adjustment of the operating lever has been made according to the diameter of hole.

Trailing Cables.—Where portable machinery has to be connected to a fixed source of electricity supply, the cables used must have exceptional resistance to corrosion, as well as other requirements imposed by the amount of flexing and chafing to which they are subjected. The Pirelli-General trailing cables listed in this booklet have an exceptionally tough rubber sheathing, and are manufactured to accord with the requirements for fully or partially protected wiring systems. Special types are available for conveyors, loaders, drills, earth screening, and split mains distribution.

Breakers and Granulators.—Hadfields Limited, Sheffield, sends an illustrated catalogue of single toggle breakers and granulators, as used for the production of road metal and concrete aggregate. The machines are fitted with the firm's patent manganese steel crushing jaws, cheek plates, and toggles. Simplicity of operation and adjustment combine with exceptionally sturdy design to produce equipment suitable for long life and hard service. The catalogue also gives particulars of portable stonebreaking and screening machinery incorporating single toggle breakers and granulators.

Reducing Valves.—Two types of reducing valve are described in illustrated leaflets received from Hopkinsons Limited, Huddersfield. Leaflet No. RV.3506 deals with a small-capacity pattern for controlling air, gas, steam or water, the action depending upon the pressure of the controlled vapour or fluid against a diaphragm and an adjustable loading spring. The valve is constructed of bronze, with Platnam seats. For controlling the delivery of gas from containers where it is stored under compression the valve described in leaflet No. RV. 3508 is recommended, as this will maintain a fixed pressure, down to a few pounds, irrespective of falling pressure in the gas cylinder.

Brass Wire Products.—The Copper Development Association, Thames House, Millbank, S.W.1, has issued a pocket handbook, uniform with its well-known series of engineering data booklets, dealing with brass and other copper alloy wires and wire products. Chapters explaining the composition and mechanical properties of copper alloy wires are followed by an illustrated survey of the great variety of rivets, nails, pins, brads, &c., in the manufacture of which they are used. Screens and gauzes are further forms in which brass wire and associated materials find a wide and successful application, particularly in the grading, sifting, washing and filtering of materials. Notes on annealing, heat treatment, pickling, bright dipping, and colouring conclude the booklet.

THE SCRAP HEAP

A movement is on foot to construct an elevated railway in Toronto. The route will include Yonge, Queen and other principal streets.—*From the "Canadian Gazette" of February* 11, 1886.

* * *

On Wednesday, February 12, the L.M.S.R. re-stocked Rudyard Lake, a feeder of the Trent and Mersey Canal, with 10,000 fish, including roach, perch, and carp. Rudyard Lake, situated between Macclesfield and Leek, is a favourite fishing ground for anglers from various parts of Staffordshire and Lancashire.

* * *

U AND I

"Both 'U' and 'I' are in business. Furthermore, 'U' comes before 'I' and 'I' is silent. But the 'U' in business is sounded as 'I,' and that would appear to indicate that if business is to be harmonious and profitable it must be an amalgamation of the interests of 'U' and 'I'."—*A quotation about partnership read by Mr. C. R. Byrom at the L.M.S. Chief Operating Manager's Department Headquarter's Staff Dinner.*

* * *

A correspondent sends us a cutting from an evening newspaper which, after announcing that Mr. H. N. Gresley has been chosen as President-Elect of the Institution of Mechanical Engineers for the ensuing year, goes on to say that "Mr. Gresley is the schoolboys' unknown hero; he is the greatest designer of express locomotives in the world."

Our correspondent, desiring to complete his knowledge on the subject, asks, "Who is the greatest designer of goods locomotives in the world?" We are obliged to confess that we do not know.

* * *

With the revival of the Olympic Games by the Greeks at the close of the last century, a marathon race was instituted over the 25-mile route of the original marathon run to Athens. The winner on the first two occasions was a young Greek named Loues, who finished in remarkable time. Greek prowess in the other events had been embarrassingly inconspicuous, so in the words of Mr. E. F. Benson in his book "As We Were." "He (Loues was hailed as a national hero, he was crowned with a wreath of wild olive by the king. Pindaric odes were written in his honour, the municipality voted him a free dinner every day till the end of his life, and the Athens-Corinth railway a free pass, for he had re-established for Greece the athletic supremacy which had been hers two thousand years ago."

The early, and scarce, handbill issued by the Midland Counties Railway in 1840, which we reproduce, is from a photograph recently sent us by a Derby reader. The subject is of particular interest during the present year, for it was on June 21, 1836, that the Midland Counties Railway was incorporated, with powers to build lines from the London & Birmingham Railway at Rugby to Leicester, Derby, and Nottingham. The formal opening of the Nottingham-Derby section took place on May 30, 1839, and public traffic began on June 4. Eleven months later the second portion was ready, namely, from Trent junction to Leicester, including two curves joining the Nottingham-Derby section at Long Eaton and Sawley junctions. This was formally inaugurated on Monday, May 4, 1840, and, as our handbill shows, public traffic began on the following day.

* *

Lloyd George remarked that an amusing article might be written on official minutes, and we began to recall some. There was Bright's famous minute written when he was President of the Board of Trade: "I have read Mr. Giffen's very able and interesting memorandum. I do not clearly apprehend whether he approves or disapproves the proposal which he discusses, but in any case I agree with him."

Then there was the minute of a former Minister of Education, which is, I believe, still religiously guarded in the archives of that department. Marking some passage in a long memorandum with a pointing hand in the margin, the Minister had added, "This is the colonel of the whole question."

The Indian and Foreign Offices gave less scope for such sallies, though there was one Ambassador at least, whose dispatches were not only full of good sense and shrewd observation, but were generally lit up by some flash of humour which made them doubly welcome, and memory dwells lovingly on a telegram reporting trouble at Mount Athos which, by an error in transmission, had been made to read, "The monks are violating their cows" instead of "their vows," on which Mr. Harold Nicholson had minuted: "This would seem to be a case for a papal bull."—*From "Down the Years," by the Rt. Hon. Sir Austen Chamberlain, K.G., P.C., M.P. (Cassell & Co. Ltd.).*

* * *

THE STAR-CARTER

Time: A cold and frosty morning.

Husband (panting from garage into house): "Where's my bag?—got to go by train!—can't get the blinking star to cart!" (Exit, still panting.)

Midland Counties RAILWAY.

THE PUBLIC ARE INFORMED, THAT THIS RAILWAY,

FROM

Nottingham and Derby,

TO

LOUGHBORO', LEICESTER,

AND THE INTERMEDIATE STATIONS.

Will be opened for the conveyance of Passengers, Parcels, Gentlemen's Carriages, Horses, and Van Goods, on TUESDAY the 5th of May.

HOURS OF DEPARTURE.

From Nottingham and Derby to Leicester.	From Leicester to Nottingham and Derby.
Eight o'Clock Morning	Half past Seven Morning
Half past Eleven Morning	Eleven o'Clock Morning
Quarter to Five Afternoon	Three o'Clock Afternoon
Quarter to Eight Evening	Half past Seven Evening
ON SUNDAYS.	**ON SUNDAYS.**
Eight o'Clock Morning	Half past Seven Morning
Half past Seven Evening.	Seven o'Clock Evening.

On the opening of the North Midland Railway, the Eight o'Clock Morning, and Quarter to Five o'Clock Afternoon Trains from Derby to Leicester will be in connexion with the Trains leaving Sheffield for Derby at Half past Five Morning, and Two o'Clock Afternoon.

The Half past Seven and Eleven o'Clock Morning Trains from Leicester, will arrive in Derby in time for the Trains of Clock Morning and Quarter to One o'Clock Afternoon Trains from Derby to Sheffield.

The Train marked *** is in connexion at Derby with Coaches to Ashbourne, Leek, Macclesfield, Stockport, Manchester, and Liverpool; also to Matlock, Bakewell, and Buxton; and at Nottingham, with Coaches to Mansfield, Newark, Lincoln, Hull, &c.

The Train marked ** is in connexion at Nottingham with a Coach to Southwell, Retford, and Gainsborough.

The Train marked * is in connexion at Nottingham with Coaches to Mansfield, Southwell, Newark, and Lincoln.

THE INTERMEDIATE STATIONS ARE

KEGWORTH, BARROW, SILEBY, AND SYSTON.

It is requested that Passengers will be at the intermediate Stations, and Carriages and Horses at principal Stations, a quarter of an Hour before the time advertised for starting.

The Doors of the Booking Offices at principal Stations will be opened precisely at the Hours appointed for departure; after which no one can be admitted to go by the Train.

FARES.

	FIRST CLASS	SECOND CLASS
From Nottingham to Leicester	6s. 0d.	4s. 6d.
From Derby to Leicester	6s. 0d.	5s. 0d.
From Nottingham to Loughborough	3s. 6d.	2s. 6d.
From Derby to Loughborough	3s. 6d.	3s. 0d.
From Leicester to Loughborough	2s. 6d.	2s. 0d.

RATES FOR PARCELS AND VAN GOODS.

Of and under 16lbs weight, for any distance under 30 Miles	6d.
Above 16lbs. and under 28lbs	9d.
Above 28lbs. and under 56lbs.	1s. 0d.
Above 56lbs. and under 112lbs.	1s. 6d.

Above 112lb. 1s. 6d. per Cwt.

N.B.—The above Rates include delivery and all other charges, except the customary Two-pence for Booking.

Persons desirous of having their Parcels, &c. by Railway, are requested to mark them conspicuously "Per Railway."

The Company will not be responsible for Parcels, &c. above the value of £10. unless declared as such at the time of booking, and entered and paid for accordingly.

In addition to the Offices at the Railway Stations, the following Receiving Houses have been appointed: where information relative to the Trains may be obtained:—In NOTTINGHAM, White Lion and Marquis.—DERBY, Ox Bell, King's Head, Tiger, and New Inn.—LOUGHBOROUGH, Red Lion.—LEICESTER, Stag and Pheasant.

(By order) **J. F. BELL, Secretary.**

Nottingham, April 28th, 1840.

J. HICKLIN, PRINTER, PELHAM STREET, NOTTINGHAM.

Midland Counties Railway timetable of 1840

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

SOUTH AFRICA

Rand-Cape Air Service

Notable improvements in the present air mail service between Johannesburg and Capetown are the subject of negotiations between the railway administration and Imperial Airways. The proposals under consideration are that Imperial Airways should make Germiston, the Rand Airport, the southern terminus of their African service, and that the South African Airways (S.A.R. & H.) should take over the Germiston-Capetown section entirely.

This arrangement is one that will suit both parties to the negotiations. It will assist Imperial Airways, who are not anxious to replace land machines because of the impending change over to seaplanes on the African route. The Union Government subsidy to Imperial Airways will not be affected by the new arrangement. On the other hand, South African Airways (S.A.R. & H.) anticipate an improvement in revenue as a result of the more attractive running schedules that will be possible under their administration.

Proposed Air Schedules

It is intended to eliminate the present overloading on the outward and return journeys, a difficulty that has hitherto stood in the way of developing passenger traffic. At present a South African Airways southbound plane leaves Germiston for Capetown about the same time as the Imperial Airways liner leaves Capetown for the north. In the future there will be four services from the Rand to Capetown, two direct and two via Durban, on different days of the week; and four return trips from Capetown to the Rand will also operate on different days.

The railway administration is also engaged on plans for a number of other improvements in its air services. An additional plane will probably be placed in service between Capetown and Port Elizabeth, a journey that costs more by train than it does by air. There will also be important improvements in the services to and from South-West Africa, as well as a number of extensions in the feeder services.

Language Bureau

It has been decided to establish a special language bureau for the railway service. Its principal object will be to secure uniformity in the use of Afrikaans. All publications, printed forms and documents intended for public scrutiny will pass through the bureau of language experts to ensure that they are word perfect. The bureau will also co-ordinate the style and substance of official documents whether in English or Afrikaans. It will standardise Afrikaans and English terms used on the railways, and will keep an eye on translation efficiency.

The existing Language Committee will be replaced by a new committee on which both the "Salstaffs" organisation and the "Spoorbond" will be represented. This committee will act in an advisory capacity to the bureau, which will not do the translating itself, but will merely scrutinise the work of others, making alterations if necessary, and send it back to the official concerned. Work that is scrutinised and corrected by the bureau will be regarded as final, and will not be subject to alteration except after consultation and with the approval of the official at the head of the bureau.

It is emphasised that officials entrusted with translation work or with the compilation of documents in Afrikaans must take very careful notice of alterations in Afrikaans spelling and terminology. In this connection the ruling of the head of the bureau will be binding on the whole railway service.

BRAZIL

Burning of National Coal

With the two-fold object of saving expenses on imported coal and developing a national industry, the Central Railway directorate has been exploring the possibilities of increasing the proportion of Brazilian coal used in its locomotives. Prior to 1934, when a Coal Commission was appointed to study the question and when a depot was established on the docks for purifying and blending the coal—reference to which was made in the January 25, 1935, issue of THE RAILWAY GAZETTE—the proportion of national to imported coal never exceeded 4 per cent., but at the present time it has reached the satisfactory average figure of 25 per cent.

Brazilian coal has been freely condemned in the press and in order to show that the criticisms were unfounded, a party of journalists was invited recently to inspect the purifying and blending depot, and also to make a trip, in company with the principal members of the Coal Commission and other engineers, on the *Auxiliar*, metre gauge section of the Central Railway behind an engine burning 80 per cent. foreign coal and 20 per cent. national fuel from the São Jeronymo mines in Rio Grande do Sul. A special train, weighing 160 tons, was made up and a 4-6-0 engine No. 1092 ran without any incident from Alfredo Maia terminus to Sertão and back, 174 km. (108 miles) in all, in 2 hr. on the outward and 2 hr. 10 min. on the return journey, the average consumption being 12 kg. a km. (32·2 lb. per mile), with a water evaporation ratio of 8·08 a kg. of coal.

It was pointed out that the Brazilian mines (in Rio Grande do Sul, Santa Catharina and Paraná) produce a bituminous coal, which gives good combustion, all volatile substances being entirely consumed, when it is mixed in reasonable proportions with semi-bituminous or anthracite coals, and there was no reason why, with proper attention to such important matters as washing the coal well before despatching it to the purifying and blending plant, the proportion used, not only by the Central Railway, but also by industrial firms, should not be increased beyond the present average of 25 per cent.

Amongst recent recommendations by the Coal Commission are the following:—

(i) That within 18 months of the signing of the contract with national mines *all* the coal supplied to the Central Railway should be delivered properly washed.

(ii) That all the slack and dust accumulating at the depot should be made into briquettes, thus avoiding the present waste of both foreign and national coal.

(iii) That the Government should purchase two modern ships for the exclusive transport of coal, in view of the heavy freights which, combined with the fact that imported coal for the Central Railway is exempted from customs duties, render the purchase of national coal almost as expensive at the present time.

SPAIN

Road and Rail Co-ordination

The conference—convoked by the Minister of Public Works—of interests concerned in the co-ordination of road and rail transport was held in Madrid on January 20. The representatives of the railways attended in full force but some of the motor interests decided to boycott the meeting. It will be remembered that after the question of co-ordination had been discussed at two previous conferences, the Government decreed that from December 1 last, motor vehicles transporting merchandise should pay the existing transport and road maintenance taxes in advance, on a commuted mileage and tonnage, to prevent the evasion of taxation that had resulted in an enormous tonnage of goods being diverted from the railways to the roads. The motor interests threatened a general strike and the then Minister of Public Works suspended the operation of the Decree *sine die*. It remains to be seen whether the reports and memorials drawn up and presented as a result of the meeting of January 20, will have the desired result, of convincing the Government of the urgent necessity of imposing legislative measures to enforce the due payment of taxes and so prevent

the railways from being penalised as they are at present.

The motor interests themselves admit that the present movement of merchandise by road would justify a total of fifty millions of pesetas in taxes, while the actual amount now received by the national exchequer under this head is something like five millions. The opposition to any corrective legislative measures is not limited to the owners of the lorries, but is supported by the unseen but powerful agencies interested in the introduction and sale of motor vehicles, who must dispose of the production of the factories at any price. There is no doubt that if the transport by road were charged with the due taxation and with a normal amount for first cost and amortisation, it could not compete with the railways on parallel routes, and would be limited, as it should be, to transport on feeder lines, and in districts not served by railways.

Backward Areas Now Neglected

As things are now the poorer districts are left without any form of transport while the lorries devote themselves to the more lucrative main roads on which they get the pick of the more easily handled and remunerative traffic previously carried by the railways.

Meanwhile the railways see their revenue diminishing at such an alarming rate that the Government has been asked to consider some emergency legislation by decree. Even the big companies are now in a position in which they are not earning their fixed charges, and M.Z.A. ordinary shares have been marked at a record low point of 137. Unfortunately all these matters are in suspense pending the General Election, which in its turn is also affecting business generally and therefore railway traffics.

FRANCE

Paris Metro Receipts in 1935

The gross income of the Metropolitain de Paris for the year 1935 amounted to Fr. 501,333,808, against Fr. 516,495,358 in 1934, a decrease of Fr. 15,161,550. These sums comprise both the urban system and the suburban extensions. For the former the total receipts are Fr. 478,943,405, against Fr. 500,121,686, while the suburban lines brought in Fr. 22,390,403, against Fr. 16,373,672. Analysis of the receipts in detail indicates some improvement in the latter part of last year.

In the first quarter of 1935, the urban receipts declined to Fr. 128,739,914, against Fr. 141,496,180 in the same period of 1934. The receipts in the second quarter were Fr. 122,320,492, against Fr. 125,860,053; in the third Fr. 97,073,924, against Fr. 99,232,143, and in the fourth Fr. 130,809,070, against Fr. 133,533,310. The relatively small totals for the third quarter are apparently explained by the fact that they cover the summer holiday period when many Parisians are absent. The increase in the gross receipts was especially marked in the last quarter, and particularly in two months when they showed a slight gain on the corresponding figures of 1934. Receipts in September were Fr. 36,053,955, against Fr. 35,874,592, and in December Fr. 48,052,703, against Fr. 47,612,060.

Railway Social Welfare Work

A brief survey of social welfare work organised by the French railways was recently given in the *Journée Industrielle*. It cites the small garden cities maintained by the Nord system at Tergnier, Lille-Délivrance and Lens. The houses of the railwaymen are built in stone and are of pleasing aspect and with comfortable interiors. The company encourages the men to keep up their gardens by distributing annual prizes to those obtaining the best results. In addition to the garden cities, the railways have built model dwellings in towns and country districts. One of these on the State system at Asnières comprises 266 dwellings and accommodates men working at the St. Lazare terminus and at the Batignolles goods station, while another at Clichy, with 80 dwellings, is used by engine-drivers and firemen who may be called upon to take out engines from the Batignolles depot at any hour of the day or night. At Nanterre a building comprising 211 dwellings is reserved for the staff employed in the workshops, on the permanent way and in the engineering services. In Paris itself, two large buildings near the Montparnasse terminus provide 185 dwellings for men of all services.

Railway "Colonies"

For several years past the railways have organised summer holidays at the seaside or in the mountains for the families of railwaymen. Models of their kind are the "colonies" established at Quiberon in Brittany and at La Meilleraie in La Vendée, as well as the "colony" at Saint-Pol-sur-Mer near Dunkerque. Another "colony" known as *La Motte* houses 500 railway apprentices. An air cure resort at Prouy-sur-Ourq serves the Nord and Est systems. The railways have also organised infant welfare work in the form of medical clinics, family grants in aid, birth allowances, nursing centres, provision of pure milk and children's gardens. On one railway system an ambulance fitted as a consulting room tours from station to station in charge of a doctor and nurse to give advice and care for infants. The railways also aid mutual welfare work and give assistance to the orphanages and sanatoria organised by French railwaymen.

Technical Training of Railwaymen

The railways facilitate the technical training of railwaymen by organising special classes of instruction, reserved for young apprentices who show aptitude in their studies. In addition to routine railway work, including scientific study of the locomotive, the elements of a good general education are included in the course. Some railways organise station schools, where the young men are initiated into various kinds of work they may be called upon to take up. This method facilitates the selection of men specially adapted to certain services.

In this connection, reference may be made to the *Laboratoire du Travail* established by the State Railways. This laboratory was formed on the initiative of M. Raoul Dautry, the General Manager, and is conducted by M. Henri Laugier, professor at the Sorbonne and at the Conservatoire des Arts et Métiers, assisted by Mlle. D. Weinberg. The aim of the laboratory is to make a choice of men best fitted for certain work involving risk by special technical, physiological and psychological tests.

VICTORIA

Track and Locomotive Progress

An important development in the track improvement programme on the Government Railways during 1935 was the use of 110-lb.-a-yard rails welded to a continuous length of 1,700 ft. through Elphinstone tunnel, 1,254 ft. in length, and to a length of 1,530 ft. through Geelong tunnel.

During the year also, the improvements to locomotive front ends, involving variations in size and location of the blast pipe, diameter of chimney, smoke box arrangement, and superheater details; and, in addition, modifications of grates; have combined to secure increases in power up to 33 per cent. in existing locomotives at certain speeds, and have made possible improvements in train schedules previously referred to in these columns. The annual average mileage for S class Pacific type locomotives was 56,198, or more than double that of the older classes. The mileage run between heavy repairs by the S class engines also averaged 82,000 as compared with 65,000 by other standard classes.

CHINA

Resumption of Peiping-Mukden Through Traffic

Arrangements have been completed for the resumption of through traffic on the Peiping-Mukden Railway between Peiping and Mukden, and through operating is anticipated in the near future. Details of the agreement have been referred to the Ministry of Railways at Nanking for approval. Through working via Shanhaikwan was suspended about four years ago between North China and Manchukuo and traffic operations will be considerably facilitated when through working is restored.

FURTHER IMPRESSIONS OF OVERSEAS TRANSPORT

IV—The author visits Johannesburg, the administrative centre of the South African Railways, and describes the architecture and amenities of Johannesburg station

By A. W. ARTHURTON, M.Inst.T., formerly Secretary, British Railways Press Bureau

MOST of our long journeys on the South African Railways took place at night, the train arriving at Bulawayo, for instance, in the early morning and leaving again in the evening. Travelling in this way naturally takes longer, but it gives the tourist an opportunity of seeing more places. The journey from Victoria Falls to Durban, a distance of 1,448 miles, took from 3.35 p.m. on Friday afternoon until 9 a.m. Tuesday, involving four nights and all Sunday on the train.

Everyone who visits Bulawayo makes the pilgrimage to the graves of Rhodes and Jameson in the Matoppos. The graves are on a hill of huge granite boulders, hundreds of tons in weight, set in the midst of a vast amphitheatre surrounded by rugged hills; the famous " world's view " from the top of the hill is one of majestic and imposing loneliness. The return journey from Bulawayo is some 60 miles, which took about 3 hours by car. On the road to the Matoppos wheel tracks of cement about 1½ ft. wide are laid on which the cars run, the rest of the road not being made up. This method of roadmaking is less expensive, and is gradually being introduced on the Rhodesian roads. It is really a return to the method of the old colliery plateways, said to be the origin of railways.

One meets former Great Western men all over the world. I found a sometime member of the General Manager's staff at Paddington (Mr. Speller) in the General Manager's office at Bulawayo. On entering the dining car later on in the day, I was pleased to meet Mr. Roger Gibb, another former colleague. Mr. Gibb is Chairman of the Rhodesia Railway Commission, or Rates Tribunal, and was going home on leave owing to ill-health.

Retracing our route from Rhodesia, the whole of the Sunday was spent in again crossing Bechuanaland and the Kalahari Desert. This endless waste of bush scenery gets monotonous after a few days, but the native passengers at the stations provided some amusement and interest. They are accompanied to the station by numbers of their friends in bizarre clothing, who congregate outside the native coaches at the end of the train.

Johannesburg, the biggest and wealthiest city in South Africa, is remarkable not only for the number and excellence of its shops, theatres, clubs, hotels, parks and racecourses, but also for its phenomenal growth. It was in 1886 that the South African gold rush took place. Johannesburg was then a mining camp composed of tents, covered wagons, and mud-walled huts with roofs of tarpaulins or reeds; today it is a city of lofty buildings, nine or ten stories in height, stately suburban homes, and a population of over 300,000. The gold reef is 70 miles from east to west, and along the whole length appear huge white mounds, almost pyramidal in size and shape, which are the residue of the hundred thousand tons of rock hoisted to the surface and crushed every day in order to extract the gold. The trucks which carry this waste material on to the enormous dumps are conveyed from the pit mouths or shafts by cableways, or on narrow gauge lines.

We were enabled to inspect one of the Geduld Proprietary Mines, which was similar to a coal mine, although not so black, and about half a mile in depth. From the working face, where men with pneumatic drills bore holes for the blasting charges of gelignite, the ore is conveyed to the shaft by electrically-hauled trucks. The reduction works at the surface are most interesting, the rock, which resembles granite in appearance, being crushed to powder and treated by the cyanide process to separate the gold. Not a vestige of gold, however, could be detected throughout the whole of the operations, but on leaving we were shown a gold brick weighing 1,000 ounces and worth about £6,000. The mines of the Rand employ altogether about 25,000 white men and 200,000 natives.

Johannesburg is also the headquarters of the South African Railways, the staff being accommodated in a massive building adjoining the new station. I was privileged to have talks on several occasions with the General Manager, Mr. T. H. Watermeyer, who during my stay in Johannesburg kindly gave a luncheon to enable me to meet his principal officers. Mr. Watermeyer showed me with justifiable satisfaction the curves of weekly traffic receipts, which have been steadily rising for some time past and have reached a point far higher than ever attained before.

I gathered from Mr. Watermeyer that a considerable extension of electrification was in hand and that it had been decided to electrify the railway lines serving the area of the Witwatersrand, which was the best way to provide the most economical relief to the present congestion in and around Johannesburg in the shortest possible space of time. By the end of 1936 the system of electrified railways in South Africa will be one of the largest in the world, and one of the most up-to-date. The mileage of electrified lines now opened or under construction is over 500 miles.

Johannesburg station is a building worthy of a city with the largest European population in Africa. The square portals are surmounted by a bas-relief frieze depicting the development of transport, and over each of the entrances is a huge elephant's head carved in stone. The station, which took 3½ years to build and cost about £750,000, covers over 16 acres of ground, and no fewer than 300 trains pass through daily. The longest platform extends for over ¼ mile, and the total platform space is 243,000 ft. The concourse is a lofty hall of graceful arches and marble pillars, with two domes open to the sky, beneath each of which is a playing fountain and fishpond. One wishes that some of our London termini could embody similar agreeable surroundings, to form a more fascinating and impressive prelude to a journey by train than is at present afforded.

A gallery somewhat like the triforium of a cathedral surrounds the concourse at street level; a marble stairway leads down from the street to the concourse, around which are shops, dining and tea rooms, hair-dressing saloons, toilet and bathrooms, suburban ticket offices, and the platform subway entrance. Twenty-eight scenes in South Africa, painted by Mr. J. H. Pierneef, who was the chief decorator of the interior of South Africa House, Trafalgar Square, adorn the walls of the concourse. It is estimated that 100 million people pass through the station every year. Pedestrian subways serving the station total approximately 2,400 ft. in length, along which brilliantly illuminated corridors are displayed artistically designed posters.

BETHNAL GREEN—ENFIELD COLOUR-LIGHT SIGNALLING, L.N.E.R.

Much of the Bethnal Green—Enfield section carries exceedingly heavy traffic, the movement of which is greatly facilitated and made safer by the new installation. Also 17 signal boxes have been closed

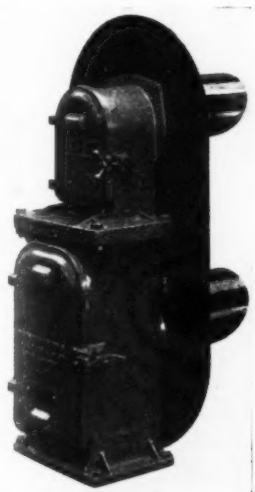
IN continuation of its steadily expanding policy of improving suburban traffic operation by the installation of automatic colour-light signals, the L.N.E.R. has, during the past 18 months, been equipping more of the Eastern Section lines—including some carrying the heaviest traffic between Bethnal Green Junction and Enfield Town. This 9½-mile length of line has been dealt with in four sections, (*a*) Hackney Downs to Seven Sisters, on which the colour-lights were brought into use on April 22, 1934; (*b*) Seven Sisters to Enfield, September 2, 1934; (*c*) Hackney Downs to Clapton, February 24, 1935; and (*d*) Bethnal Green to Hackney Downs, the most important four-track section, where the work was completed on Sunday, November 17 last. Altogether the new installation has enabled no fewer than 17 signal boxes to be closed, as follow:—

Bethnal Green to Hackney Downs	3
Hackney Downs to Seven Sisters	4
Seven Sisters to Enfield	7
Hackney Downs to Clapton	3
	17

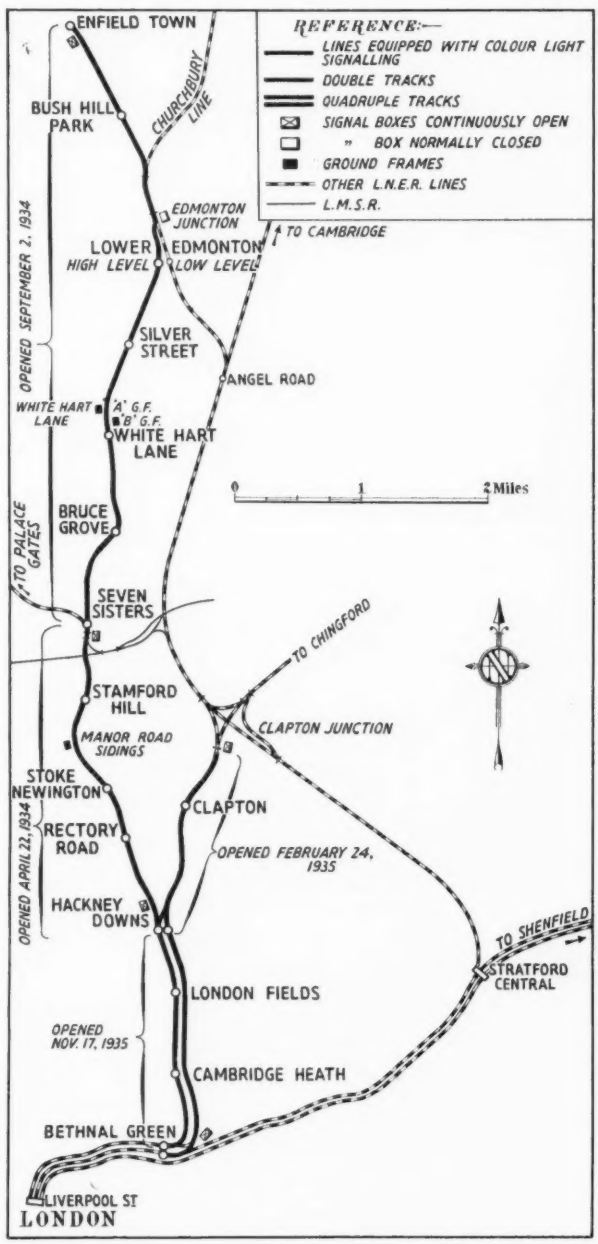
A very considerable saving in operating expenses is therefore secured as well as a valuable speeding up of traffic, especially in the foggy weather which is rather prevalent in this area. The added safety of track-circuit controlled colour-lights is also inestimable.

The Types of Signal

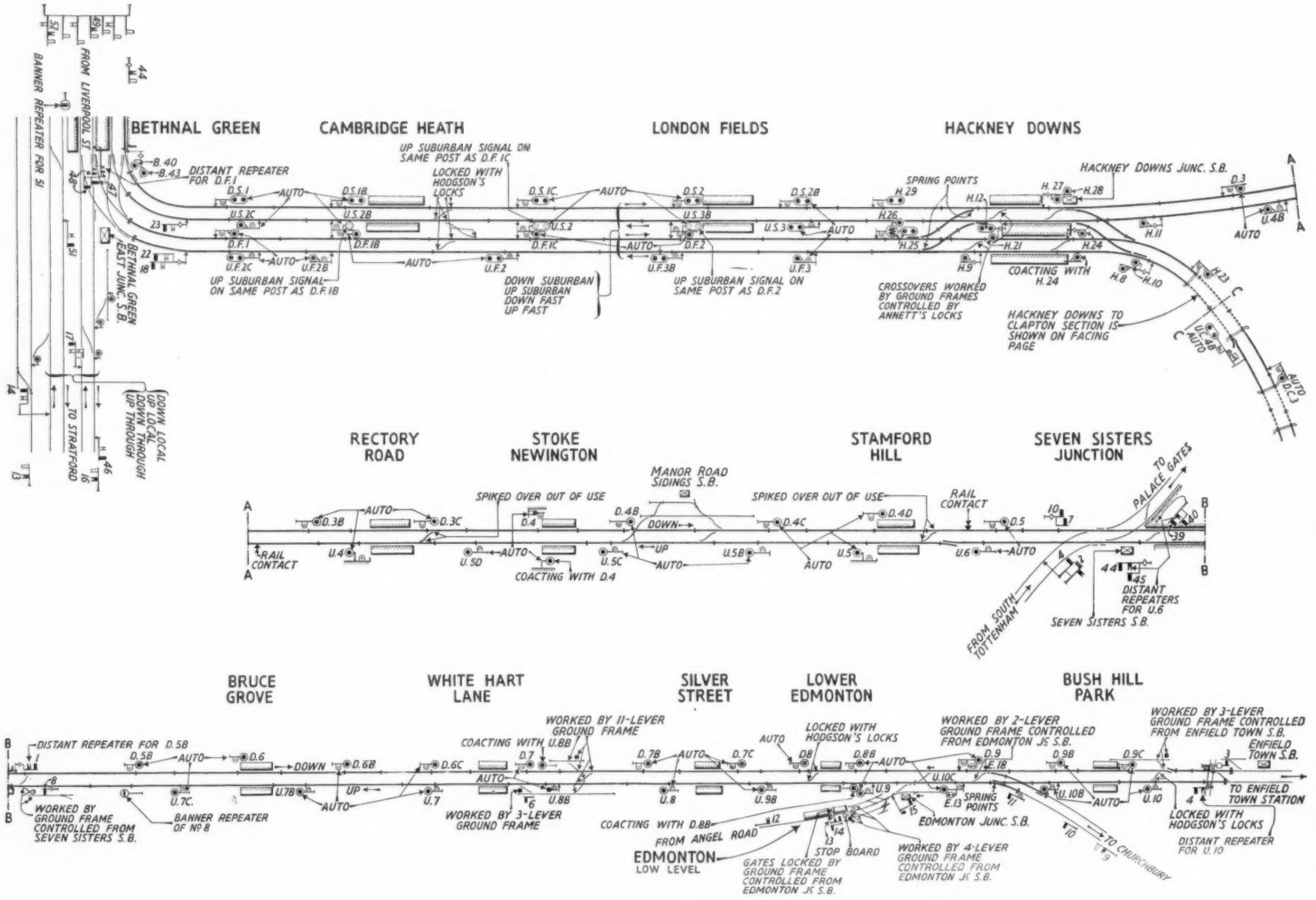
The signals now installed are of the three- and four-aspect searchlight type, controlled by a.c. track circuits, or, as at Hackney Downs, Bethnal Green, and Edmonton, by mechanically interlocked levers in the signal box. These signals give a high candle power beam produced by a special lens and reflector system, and 12-volt 12-watt lamps. They can be accurately aligned by reason of a special sighting aperture which is provided with cross hair lines. The colours displayed are produced by a small moving spectacle placed between the lamp and lens system, as described on page 95 in THE RAILWAY GAZETTE of January 19, 1934. The searchlight signals are of the d.c. permanent magnet type, fed through full wave rectifiers and transformers off 110-volt a.c. control lines. All signals are fitted with deflecting prisms or lenses for close-up indication. To enable the double yellow aspect to be displayed, there is a neat combination of units, the lower one housing the Westinghouse standard searchlight signal, while the upper is an optical yellow-lens unit, as used for a multi-aspect signal. By merely removing the cover of the lower unit, the upper one can be bolted to it, and is automatically aligned, as both the bearing faces are accurately machined to secure parallel alignment. A single display board covers both lenses. There are altogether some 79 colour-light signals

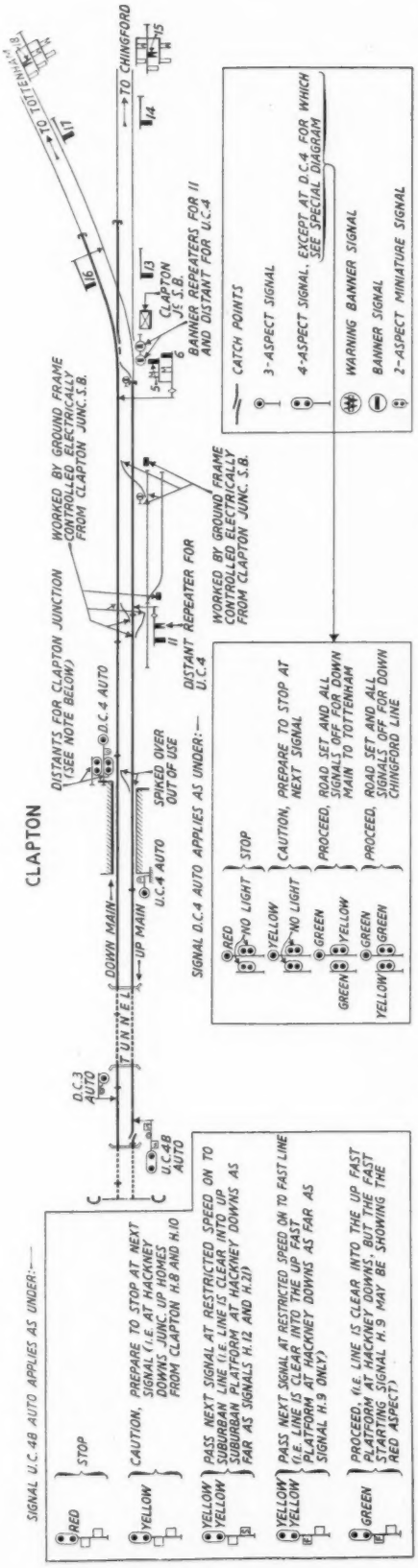


Westinghouse pattern two-unit combined signal



Key map showing the four sections of line recently equipped with colour-light signals


BETHNAL GREEN
CAMBRIDGE HEATH
LONDON FIELDS
HACKNEY DOWNS
BANNER REPEATER FOR SI
FROM LIVERPOOL ST.
BETHNAL GREEN EAST JUNC. S.B.
TO STRATFORD
DOWN LOCAL UP LOCAL DOWN THROUGH UP THROUGH
DISTANT REPEATER FOR D.F.1
UP SUBURBAN SIGNAL ON SAME POST AS D.F.1C
LOCKED WITH HODGSON'S LOCKS
UP SUBURBAN SIGNAL ON SAME POST AS D.F.1B
DOWN SUBURBAN UP SUBURBAN DOWN FAST UP FAST
UP SUBURBAN SIGNAL ON SAME POST AS D.F.2
SPRING POINTS
CROSSOVERS WORKED BY GROUND FRAMES CONTROLLED BY ANNETT'S LOCKS
COACTING WITH H.24
HACKNEY DOWNS JUNC. S.B.
HACKNEY DOWNS TO CLAPTON SECTION IS SHOWN ON FACING PAGE
RECTORY ROAD
STOKE NEWINGTON
STAMFORD HILL
SEVEN SISTERS JUNCTION
MANOR ROAD SIDINGS S.B.
SPIKED OVER OUT OF USE
RAIL CONTACT
COACTING WITH D.4
PALACE GATES
DISTANT REPEATERS FOR U.6
SEVEN SISTERS S.B.
FROM SOUTH TOTTENHAM
BRUCE GROVE
WHITE HART LANE
SILVER STREET
LOWER EDMONTON
BUSH HILL PARK
DISTANT REPEATER FOR D.5B
WORKED BY GROUND FRAME CONTROLLED FROM SEVEN SISTERS S.B.
BANNER REPEATER OF No 8
WORKED BY 3-LEVER GROUND FRAME
WORKED BY 11-LEVER GROUND FRAME
COACTING WITH U.8B
COACTING WITH D.8B
FROM ANGEL ROAD
EDMONTON LOW LEVEL
GATES LOCKED BY GROUND FRAME CONTROLLED FROM EDMONTON JC S.B.
STOP BOARD
WORKED BY 4-LEVER GROUND FRAME CONTROLLED FROM EDMONTON JC S.B.
WORKED BY 2-LEVER GROUND FRAME CONTROLLED FROM EDMONTON JC S.B.
EDMONTON JUNC. S.B.
SPRING POINTS
TO CHURCHBURY
WORKED BY 3-LEVER GROUND FRAME CONTROLLED FROM ENFIELD TOWN S.B.
ENFIELD TOWN S.B.
TO ENFIELD TOWN STATION
LOCKED WITH HODGSON'S LOCKS
DISTANT REPEATER FOR U.10


CLAPTON
TO TOTTENHAM
TO CHINGFORD
DOWN MAIN
UP MAIN
U.N.E.L.
D.C.3 AUTO
U.C.48 AUTO
U.C.4 AUTO
D.C.4 AUTO
SPIKED OVER OUT OF USE
DISTANTS FOR CLAPTON JUNCTION (SEE NOTE BELOW)
WORKED BY GROUND FRAME CONTROLLED ELECTRICALLY FROM CLAPTON JUNC. S.B.
CLAPTON Jct. S.B.
BANNER REPEATERS FOR II AND DISTANT FOR U.C.4
DISTANT REPEATER FOR U.C.4
SIGNAL D.C.4 AUTO APPLIES AS UNDER:—
RED STOP
YELLOW NO LIGHT
YELLOW CAUTION, PREPARE TO STOP AT NEXT SIGNAL
GREEN NO LIGHT
GREEN YELLOW PROCEED, ROAD SET AND ALL SIGNALS OFF FOR DOWN MAIN TO TOTTENHAM
YELLOW GREEN PROCEED, ROAD SET AND ALL SIGNALS OFF FOR DOWN CHINGFORD LINE
CATCH POINTS
3-ASPECT SIGNAL
4-ASPECT SIGNAL, EXCEPT AT D.C.4 FOR WHICH SEE SPECIAL DIAGRAM
WARNING BANNER SIGNAL
BANNER SIGNAL
2-ASPECT MINIATURE SIGNAL
SIGNAL U.C.48 AUTO APPLIES AS UNDER:—
RED STOP
YELLOW CAUTION, PREPARE TO STOP AT NEXT SIGNAL (i.e. AT HACKNEY DOWNS JUNC. UP MAIN FROM CLAPTON H.8 AND H.10
YELLOW YELLOW PASS NEXT SIGNAL AT RESTRICTED SPEED ON TO SUBURBAN LINE (i.e. LINE IS CLEAR INTO UP SUBURBAN PLATFORM AT HACKNEY DOWNS AS FAR AS SIGNALS H.12 AND H.20)
YELLOW YELLOW PASS NEXT SIGNAL AT RESTRICTED SPEED ON TO FAST LINE (i.e. LINE IS CLEAR INTO UP FAST PLATFORM AT HACKNEY DOWNS AS FAR AS SIGNAL H.9 ONLY)
GREEN PROCEED, (i.e. LINE IS CLEAR INTO THE UP FAST PLATFORM AT HACKNEY DOWNS; BUT THE FAST STARTING SIGNAL H.9 MAY BE SHOWING THE RED ASPECT)

Bethnal Green—Enfield colour-light signalling scheme, L.N.E.R.: Diagrams of (on page 334) the through route to Enfield comprising sections (d), (a), and (b)—in that order—arranged continuously, and (on this page) section (c) the Hackney Downs—Clapton length of the Cambridge main line

in this 9½-mile installation between Bethnal Green and Enfield, namely:—

	Searchlight Type Automatic	Controlled	Total
Three-aspect	48	12	60
Four-aspect	12	3	15
Multiple-aspect Type			
Two-aspect	—	—	4
			79

Proving

The control circuits for all colour-light signals are so arranged that should the lamp fail in one case the signal in rear will be held at red or "on." At the same time an audible warning of the failure is given to the signalman in the advance cabin. Also, should the searchlight signal mechanism fail to return to "red" in the event of its control being interrupted, the lamp is extinguished, thus preventing any false signal being shown: and at the same time the rear signal is held at "on" or red.

A new signal device is fitted to the controlled up Clapton line colour-light signal UC4B, that has replaced the old mechanical splitting distants, and is of more than ordinary interest. Situated beyond a tunnel (at the end of the abandoned Queens Road station platform), this signal has two route indicators which show either "F" or "S"—either of which may accompany either a green or a double yellow aspect—according to whether the approaching train is to be run over the fast or the suburban line at and beyond Hackney Downs Junction (see page 338).

Hackney Downs Box

The most interesting signal boxes on this section are Hackney Downs, Seven Sisters and also, perhaps, Edmonton Junction, which, however, is normally switched out and is opened only for goods and empty train working to and from Edmonton and the Cheshunt branch. At Hackney Downs box the mechanical frame and interlocking have been retained, the only alteration to the former being the shortened levers for operating the colour-light controlled signals at this important junction. In accordance with Southern Area standard practice the block shelf indicators for all controlled colour-light signals show either red, when the signal is at danger, or "off," when it is showing green, yellow or double yellow: the point lever indicators show "N" (normal) and "R" (reverse). These neat indicators are of moulded bakelite in units which can be built up to provide any required number of indications. Also in accordance with that practice* the track circuit illuminated diagram shows white spot-lights to indicate the unoccupied track circuits. A train entering any of these track-circuited sections extinguishes the corresponding light on the diagram, and thus indicates its position on the line (see page 337).

Indicator Diagrams and Track Circuits

Here and also at Bethnal Green, Clapton Junction, Seven Sisters and Enfield, the spot-light indicator diagrams show the line as far back as the first automatic signal a train reaches after it passes the last signal controlled from the signal box in rear, in addition to all those tracks which control functions in the cabin. This is necessary since there is no "stop and proceed" rule in force, and the signalman must know the condition of the line before giving a driver who has been stopped by an automatic signal permission to proceed.

The track circuits throughout are of the a.c. double rail type with reactance feed from independent transformers and double element resonated vane type relays.

* This is a safety-first practice by which any fault in, or failure of, the circuit or lamp, produces the indication of "train in section" by extinguishing the relevant light on the diagram.

They are designed to satisfy the requirements of future electrification.

Change-over Difficulties and Density of Traffic

One of the greatest difficulties encountered by the contractors in the signal box conversion work was the finding of room in the cramped space below Hackney Downs and other boxes for dual equipment during the various change-over periods from one stage of the work to another. For instance, there were three or more stages in Hackney Downs box—due to the contracts for the three adjacent sections being let at different times—and the accommodation of the relays and other electrical equipment without disturbing the mechanical frame and locking needed no little ingenuity.

The old mechanical signalling had been controlled by the Sykes lock-and-block and no fewer than eight Sykes instruments have now been eliminated at Hackney Downs box. It is significant that during peak hours this box passes as many as 58 up and down trains an hour. The nominal headway between green and green is three minutes, but the actual headway at busiest times is about 1¾ min. between yellow lights. The newly equipped Hackney Downs box includes the working originally carried out by Hackney Downs South, now closed.

Telephones

Telephones are provided at all automatic signals and also at such controlled signals as are out of reach of the cabin, to communicate with the cabin ahead. This equipment is specially designed, one pair of lines serving all signals on one road. The cabin set is provided with an indicator to show from which signal the call is being made. It is impossible, once the line is engaged, for a second call to be made, and should this be attempted an indication is given that the line is engaged. A general description of this system of telephones appeared on page 97 in THE RAILWAY GAZETTE of January 19, 1934.

Seven Sisters Junction

At Seven Sisters Junction there are no controlled colour-light signals, the junction territory still being mechanically signalled owing to this system being retained on the two branch lines to Tottenham and Palace Gates. There are in this box three illuminated diagrams: (*a*) the Hackney Downs—Seven Sisters diagram with the down line track circuits indicated by lights; (*b*) the Seven Sisters Junction territory diagram with both lines indicated by lights; and (*c*) the Seven Sisters Junction—Enfield diagram with the up line illuminated, when unoccupied.

Edmonton Junction

The cabin at Edmonton Junction is retained for working traffic to and from the Churchbury and Angel Road lines, but since this traffic consists only of an occasional goods or empty stock train, the cabin is normally closed, the main signals working automatically. Should a train be approaching either of the junction protecting signals when the cabin is switched in, it is impossible for the signalman fully to replace his levers controlling such signals until the train has been brought to a stand. This is effected by means of time relays working in conjunction with the berth tracks at the signals concerned.

Ground Frames and Point Machines

At Manor Road and White Hart Lane there are ground frames controlling connections between the main lines and sidings. These ground frames have controls on the automatic signals leading over the connections in order to protect shunting movements. These controls are similar to those in force at Edmonton Junction; that is, should the man operating the ground frame attempt to pull the control lever whilst a train is approaching the signal concerned, the lever cannot be pulled fully over and so release the point connections until such time as the approaching train has been brought to a standstill at the signal. Point machines at Edmonton Junction and Hackney Downs are 110-volt a.c. type, remote controlled from the cabin by means of a controller situated adjacent to the machine.

Power Supply

Current is supplied to the installation at three points, Cambridge Heath, Seven Sisters, and Clapton station. The current for the Bethnal Green—Hackney Downs section is taken from the railway company's main, and is supplied by the West Ham Corporation. A standby is taken at Cambridge Heath from the Bethnal Green Borough Council supply; both these supplies are 415-volt 4-phase. Automatic changeover equipment is provided. The changeover is accompanied by the sounding of a klaxon horn which—as the signalling sub-station is just behind the signal box—warns the signalman, who informs the linemen to inspect the circuits and take steps to rectify the defect. The supply is converted to 600-volt 2-phase by means of duplicate Scott connected transformers, the two phases being fed north and south respectively from Cambridge Heath. A similar arrangement is provided for the Seven Sisters-Enfield and Seven Sisters—Hackney Downs sections. In this case the main supply is taken from the North Metropolitan Electric Supply Co. Ltd. at Seven Sisters, and the railway company's supply is used as standby. Scott transformers are used, one phase feeding each of the two sections.

In the case of the Hackney Downs—Clapton section, no a.c. standby supply was available. One phase of the company's supply at 230-volt is used for the main supply with transformers to step the voltage up to 600 V. The auxiliary is a 480-volt d.c. supply from the Hackney Borough Council. A motor alternator set, with automatic starting in the case of a failure of the main supply, is provided. This set is equipped with automatic frequency control (see illustrations on page 339).

Cable Work

The main cables are of multicore type, paper insulated, lead sheathed and jute served, and are run on stakes supported alongside the track, except in the case of the section between Bethnal Green and Hackney Downs, where a large proportion of the cable is generally of the same type, but is steel armoured and buried direct in the ground. The cables are jointed in special terminal boxes, one of which is illustrated, but where brought into the signal cabins, they are terminated in special sealing terminal boxes. A point of interest is the neat method of wiring in which every wire is labelled on the B.S.I. system. For each signal box and for every apparatus case, terminal board, &c., a drawing is provided showing the exact wiring, and with the aid of this labelling system, it is easy for the linesman at once to trace any connection that may be required. The apparatus installed outside the signal boxes is mounted in apparatus cases of the sheet metal welded type, one of which we illustrate.

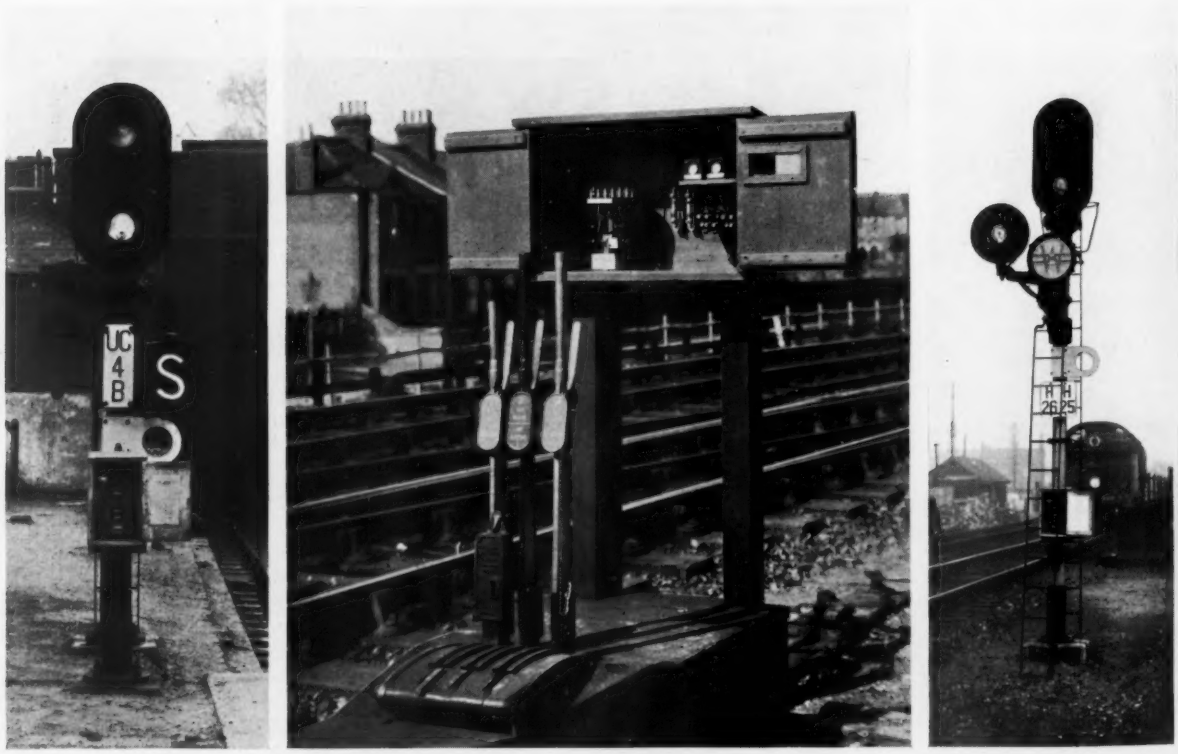
The Westinghouse Brake and Signal Co. Ltd. has been responsible for both the supply and the installation of the whole equipment. The sub-contractors for the cables were the Craigpark Electric Cable Co. Ltd. The work has been executed under the direction of Messrs. F. Downes and C. Carslake, Signal and Telegraph and Assistant Signal and Telegraph Engineers, Southern Area, L.N.E.R., to whom we are indebted for the opportunity of viewing the various works and for information concerning them.

Edmonton Junction signal box : ground floor interior, with lever locks and circuit closers

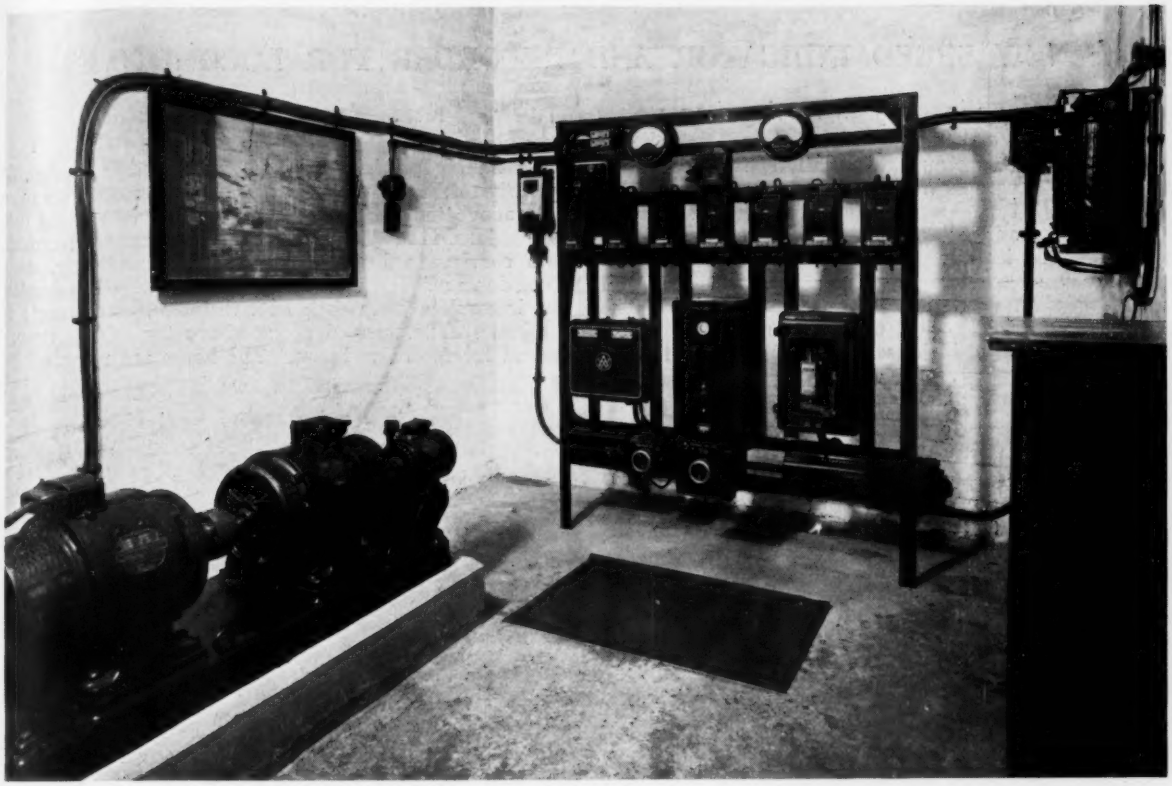
Interior of Hackney Downs signal box, showing lever frame, illuminated diagram, and block shelf indicators

BETHNAL GREEN—ENFIELD COLOUR-LIGHT SIGNALLING, L.N.E.R.

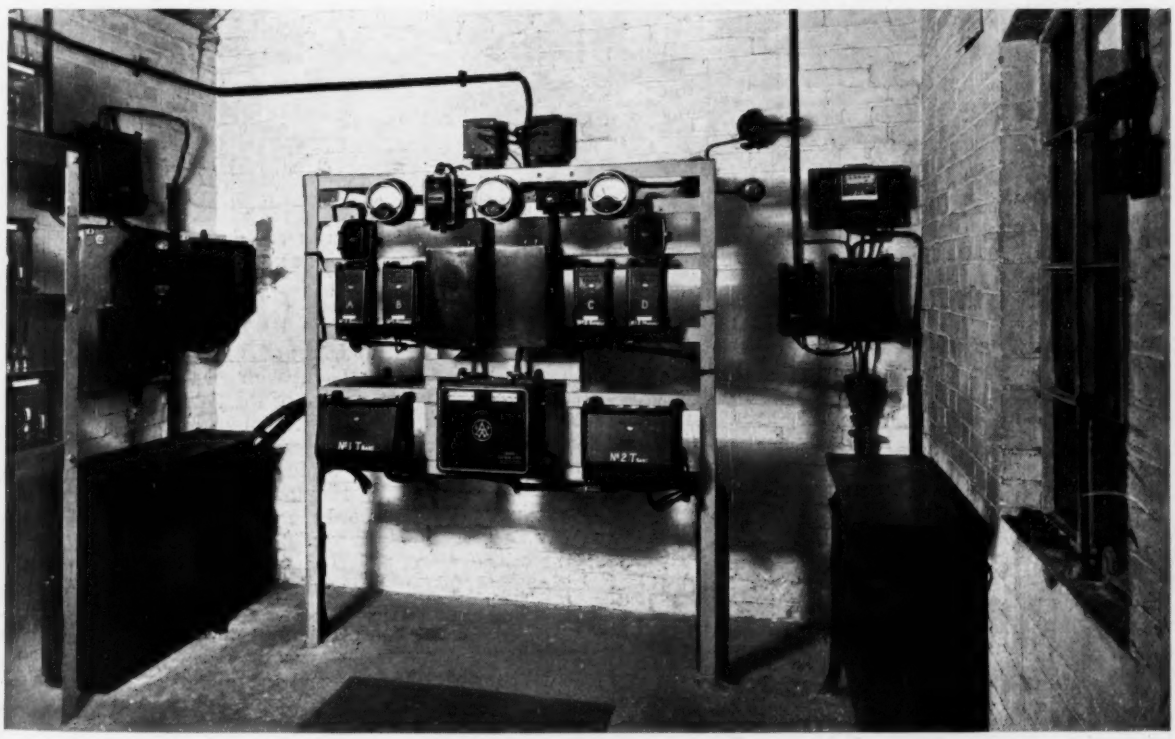
Apparatus case and disconnection box at location U 7 C (Bruce Grove)



Left: Clapton line up distant signal, specially equipped with "F" and "S" route indicators to show a driver whether he is to be put on to the fast or suburban line at Hackney Downs; it takes the place of splitting distant signals. Centre: White Hart Lane sidings 3-lever ground frame. Right: Hackney Downs down fast junction splitting signals with "W" banner or warning signal for admitting a train into the station



Clapton power house, showing motor-alternator set and automatic starting and changeover equipment



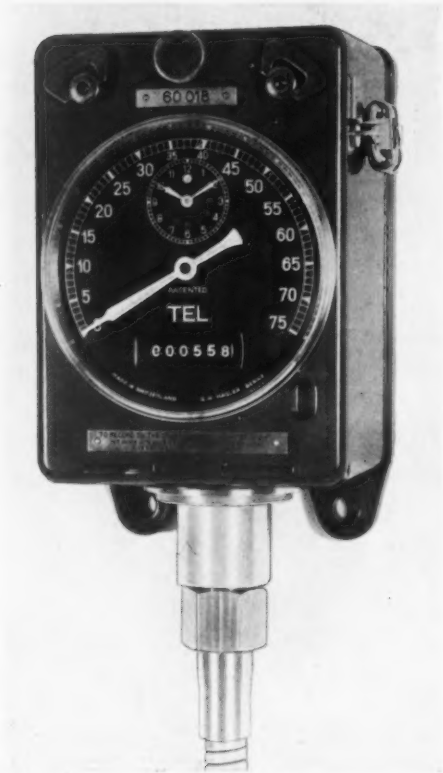
Seven Sisters power house with duplicate main transformers and automatic changeover equipment

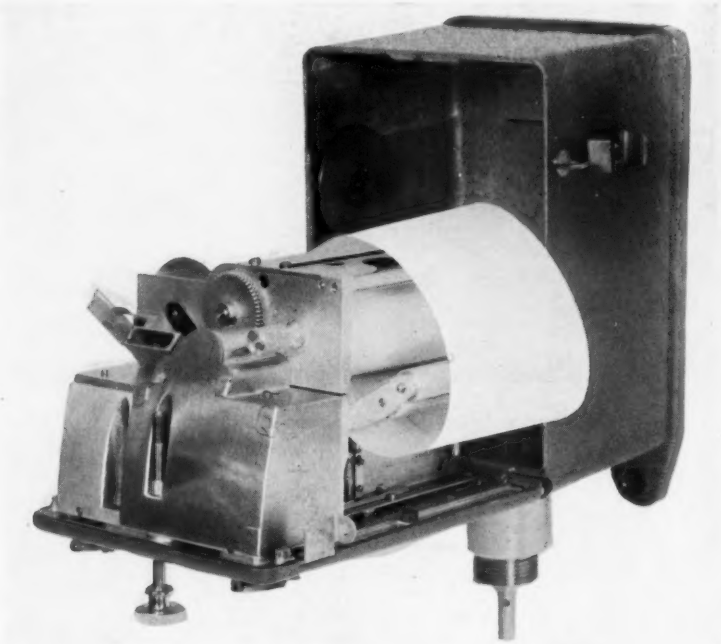
BETHNAL GREEN—ENFIELD COLOUR-LIGHT SIGNALLING, L.N.E.R.

A NEW SPEED INDICATOR AND RECORDER FOR LOCOMOTIVES

An appliance of increasing importance in view of the tendency to higher speeds

THE Tel RT835 instrument, recently introduced by the Hasler Telegraph Works, London, is of the graphic recording type for checking the speed of locomotives, railcars, and all classes of vehicles, as well as machines. The instrument is fitted with a clock which runs for 30 consecutive hours. It has been designed for flexible shaft drive in place of solid shafting. The spindle is provided with ball bearings, and consequently can be run at high speed, thus eliminating the use of expensive gearboxes. The usual method of taking the drive is, in the case of a diesel or electric locomotive or railcar, by means of a small gearbox fitted to the existing axlebox cover, the drive being by a pin on the end of the journal. In the case of steam locomotives the drive is transmitted through the coupling rod driving a crank on a small gearbox fitted to the underside of the footplate.



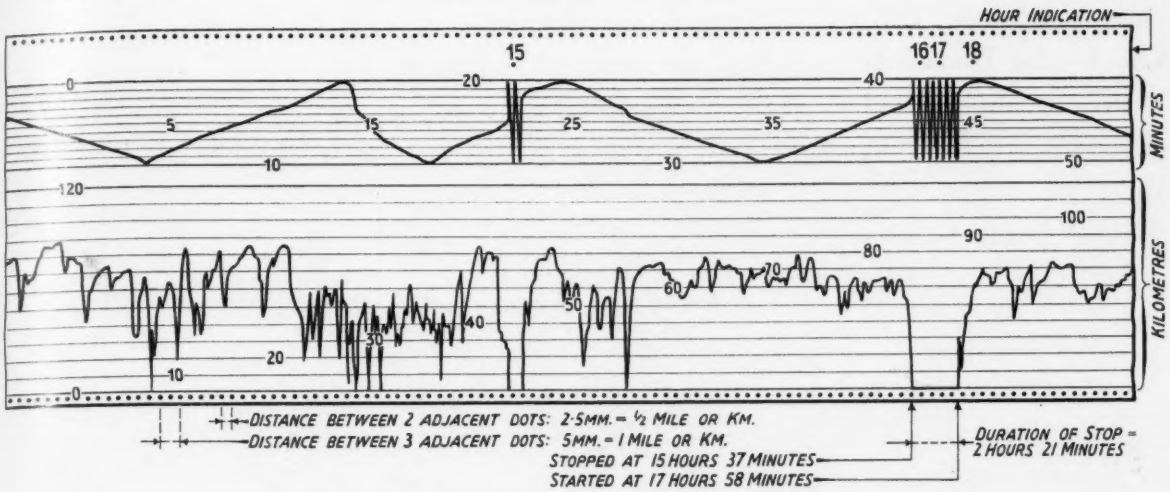


The new Hasler speed indicator and recorder for locomotives. The illustration above shows the instrument open for removal of record

The records of the Tel RT835 are made by means of a small steel movable ball mounted in a suitable stylus holder, which makes a continuous line on a specially prepared semi-transparent paper, and gives exceptionally clear recorded diagrams. Time is recorded graphically by means of figures marked on the paper, and can be read at a glance. When the vehicle is standing, the paper is fed by the clock, but at a reduced speed. The paper feed is 5 mm. per mile or km. when the instrument is in operation, and 5 mm. per hour when the spindle of the instrument is stopped. The width of the recording paper is 92 mm.

At the lower section of the paper a portion 50 mm. wide is used for the record of speed, and is graduated similarly to the dial of the instrument. A section 20 mm. wide above the speed record, and divided by lines into 10 divisions, is used for the minutes. These are recorded by a continuous line alternately rising and falling, each up or down movement of 20 mm. representing 10 minutes. The interval between each line, therefore, corresponds to 1 minute. The unruled space above the minute record is used for recording hours. The hours are recorded by an entirely new method, not adopted in any other instrument. A wheel is provided with 24 sets of points, each set forming a figure of one of the 24 hours. This wheel rotates behind the paper driven by the clock mechanism. At each hour a pawl is released and causes the wheel to be forced momentarily against the paper, and the corresponding hour in figures is punctured on to the record. An examination of the record reproduced will readily show the advantages of this new method which enables the hour to be read off at once. The part of the record where the rising and falling lines, representing minutes, are very close together, corresponds to the paper feed during stops, *viz.*: 5 mm. per hour. The puncture on the paper under each hour represents the exact corresponding point on the minute record. The external appearance of the instrument is shown in the first illustration.

For application to electric locomotives, &c., where instruments in each cab are required, a non-recording speed indicator, type Tel A.1031, is provided for the second cab. Its indicating mechanism is identical with the Tel RT835



Record from Tel RT835 speed indicator and recorder

speed indicator and recorder, and the parts are interchangeable.

The mechanism of Tel RT835 instrument is of the conjugate type. The principle consists in indicating, by means of a pointer or graphic recorder, the displacement of a part during a predetermined time interval. The operation of the Tel instrument is therefore dependent upon two movements; one constant and the other variable. The constant movement is obtained by a simple clock mechanism, whilst the variable movement, which is proportional to the speed, is applied to the spindle of the instrument by suitable gearing from the wheels in motion.

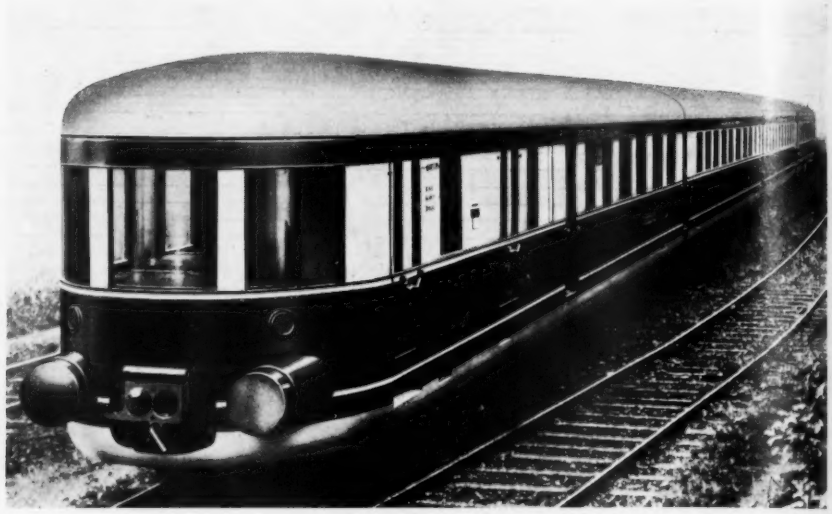
The combination of the two movements by a special arrangement called the measuring mechanism enables the speed to be measured and transmitted to the pointer or to the recording stylus. By means of the clock escapement, this constant time measuring mechanism is geared during a predetermined period with the mechanism of the variable movement. During this exact period the measuring piece is moved an amount proportional to the speed. This displacement is transmitted to the pointer, after which the measuring mechanism returns to zero to recommence its movement for the following period.

The instruments have been specially designed to facilitate maintenance. On the recording instrument there are three principal parts, which can be removed for repair or adjustment and replaced by a duplicate part which is interchangeable. These parts consist of the following: speed recording mechanisms; time recording mechanism; measuring movement. As will be seen from the illustrations, the instruments can be fitted with total mileage counters.

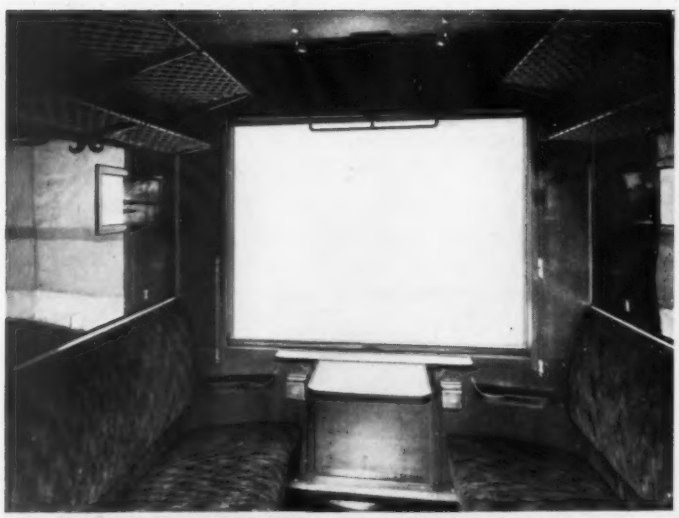
The First Public Railway in Canada

In view of the approaching centenary of opening of the first public railway in Canada, the Royal Bank of Canada has made this event the subject of its calendar for 1936. The illustration which we reproduce alongside is from a painting of the inaugural train, headed by the Stephenson-built locomotive *Dorchester*, leaving Laprairie on July 21, 1836. It was specially painted for the calendar by Mr. Sherriff Scott, a native of Scotland, who obtained his early training in Edinburgh, where he met with considerable success. His work in Canada is well known. He has executed mural paintings in the Mount Royal Hotel, Montreal, the Royal York Hotel, Toronto, the Seigniory Club, Montebello, P.Q., the Hudson's Bay Company, Winnipeg, and the St. Denis Theatre, Montreal. Mr. Scott concentrates largely on historical subjects, and has done many paintings of this nature for the Dominion Archives, Ottawa. In preparing the picture we reproduce, Mr. Sherriff Scott made a detailed study of the available evidence in order to secure accuracy in depicting the scene of 100 years ago when the Champlain & St. Lawrence Railroad Company formally opened its line from Laprairie to St. John's.

Coaches for Henschel-built steam hauled streamlined express German State Railway



Exterior view



Interior of third and second class coaches and dining car. Note scientifically shaped seats in the second class, which is now standard for new German main line stock. (See editorial note on page 322)

A MODERN FLANGING SHOP

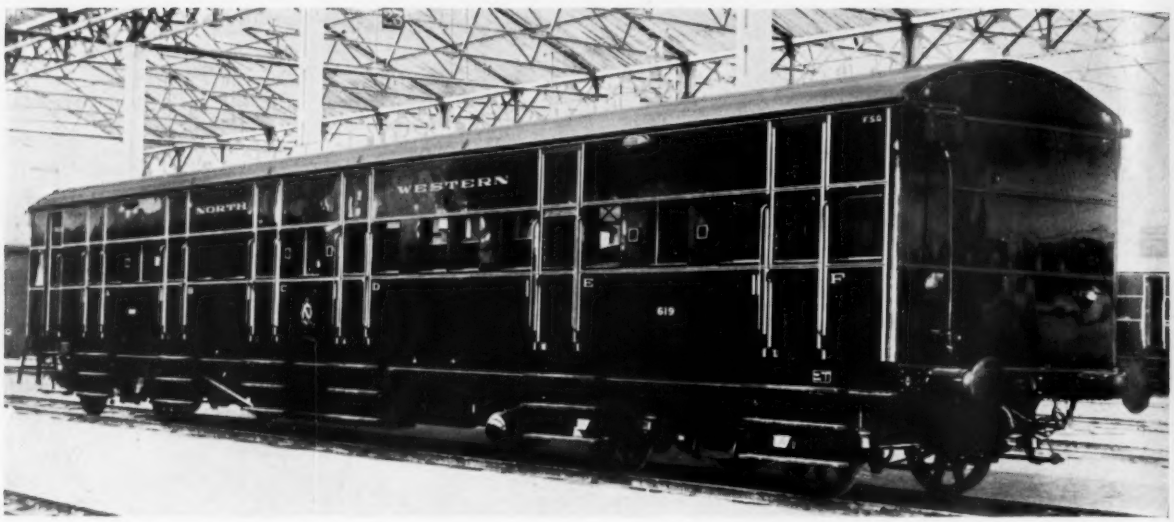
IN order to increase output and reduce costs, the North British Locomotive Co. Ltd. some few years ago concentrated its flanging equipment in one spacious building. Previously all three works comprised in the company's organisation had met their individual requirements with their own equipment. The flanging shop as now arranged is shown in the accompanying illustration. The building, which is known as the Marne flanging shop, is 420 ft. long by 90 ft. wide by 30 ft. high to the roof trusses. The equipment comprises six vertical multi-ram presses ranging from 150 to 800 tons maximum pressure, a two-ram vertical and horizontal press with, in addition, vertical and horizontal band saws. The shop is served by overhead cranes of 10 tons capacity, and the hydraulic equipment consists of three sets of three-throw pumps with accumulators, which supply pressure at 1,500 lb. per sq. in. The 800-ton press is capable of dealing with plates up to 15 ft. by 11 ft. by $1\frac{1}{4}$ in. thick prior to flanging, and here a head room of 10 ft. is available.

The company's long experience in the building of locomotive boilers, in which flanged plates of accurate profile, and of material in the best metallurgical condition are essential, together with the complete and modern facilities afforded by the Marne flanging shop, make it possible to produce flanged plates for all purposes. The locomotive boiler, having to be supported on the frame at definitely determined points and with small clearances, must be built with great accuracy, and this can be effected only by using flanged plates true to drawing, as these virtually form the foundation on which the boiler is built. A speciality is made, in this shop, of the production of accurate flanging blocks, by which means only can plates correct to form be produced. The illustration shows several examples of the work performed in the shop, and in a pamphlet recently issued by the North British Locomotive Co. Ltd. illustrations are given of numerous other items, including flanged end plates, manholes for tank wagons, steam dome, throat and tube plates for any type of boiler, casings for poppet valve gear and safety valves, splashers, and piston valve bodies. It is pointed out in the pamphlet that the company is prepared to undertake the flanging of plates in all forms of built-up structures, and to consider any complicated or abnormal forms which may be submitted.

The train staff used on the Brill branch, a very heavy brass instrument with a key at one end and a large disc at the other, has arrived for preservation in the Railway Museum, York. It has been deposited by agreement between the London Passenger Transport Board and the L.N.E.R., the two partners in the Metropolitan and Great Central Joint Committee, which worked the Brill line until it was closed on November 30 last. This line formed the subject of a short historical article in our issue of December 6, 1935, pages 982–3

ENAMELLED COACHES IN INDIA

A new type of upper class bogie coach being constructed at Moghalpura shops, North Western Railway, with Vitreous enamel side panelling, special air duct ventilation and dust excluding fittings

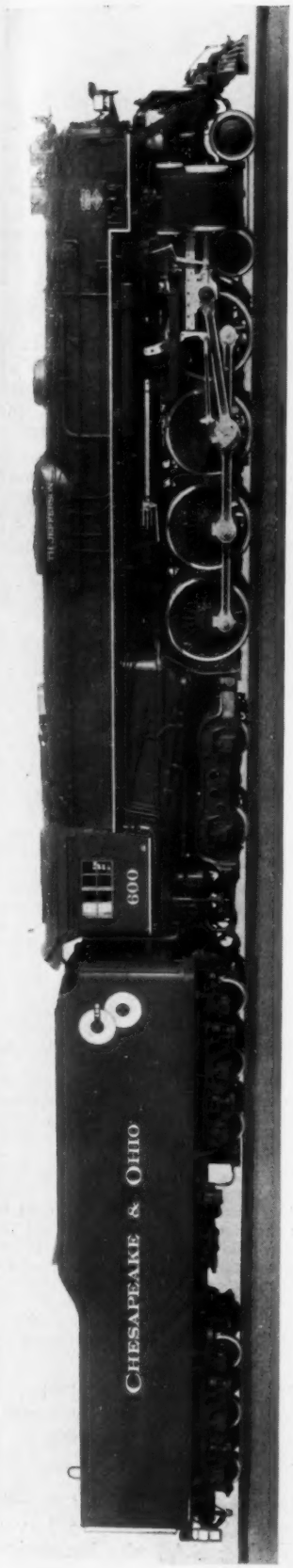


A NEW type of first and second class composite bogie coach is at present under construction at the Mogalpura (Lahore) carriage shops of the North Western Railway of India. Mounted on standard I.S.R. 68-ft. steel underframes, supplied by Burn & Co., of Howrah, the body framework is of Burma teak, but the panels and mouldings are of Vitreous enamel. Though this type of pannelling has been tried elsewhere, it is new, if not to India, at least to the N.W.R. The panels, which were supplied by J. Stone & Co. Ltd., London, had to be cut and drilled prior to enamelling to obviate subsequent shipping, but this fact necessitated special care in the following of the drawings.

The interior panelling is in polished teak and the ceilings are of plain white Sundeala boarding. Indian standard statue-bronze fittings are used, and harmonise well with the dark green Rexine upholstery. Beclawat balanced windows, with felt running channels, are fitted to keep out the dust, which is such a bugbear in Northern India. A special system of air ducts is provided to ensure that passengers in the upper berths shall have fresh air. In connection with the Kent couplers at the ends of each coach, I.S.R. standard combined fuse and junction boxes are fitted. We are indebted to the editor of *The N.W.R. Magazine* for permission to use the accompanying illustrations and facts in the text.

Low-Loading Platform Trucks

One of a fleet of Greenbat electric trucks recently supplied to the L.M.S.R. goods depot, Oldham Road, Manchester. It will be noticed that these trucks have an exceptionally large loading platform and a low height from the ground



New 4-8-4 type locomotive of unusual dimensions, Chesapeake & Ohio Railway

NEW AMERICAN 4-8-4 TYPE LOCOMOTIVES

Five locomotives as illustrated have recently been completed by the Lima Locomotive Works Incorporated, for the Chesapeake & Ohio Railway

TO meet requirements of a specially severe kind, involving the hauling of heavy passenger trains over a hard, mountainous division, the Lima Locomotive Works Incorporated has recently built, for the Chesapeake & Ohio Railway, five 4-8-4 type locomotives of the design illustrated. It is expected that these engines will each develop at least 5,000 h.p. The cylinders drive the second pair of coupled wheels, and the engines are fitted with the Woodard tandem main rod drive system. The engines, which are unusually large, are described by the builders as of rugged design, well adapted to the very heavy demands that will be made upon them. The following are the main particulars :—

Cylinders (2) dia.	27½ in.
Piston stroke	30 in.
Wheels, coupled	6 ft. 0 in.
Wheelbase, coupled	19 ft. 3 in.
,, engine	46 ft. 10½ in.
,, engine and tender	98 ft. 5¼ in.
Boiler, dia.	7 ft. 7 in.
Steam pressure	250 lb. per sq. in.
Heating surface :—	
Tubes and flues	5,013 sq. ft.
Firebox and combustion chamber	396 ,,
Arch tubes and syphons	129 ,,
Total (evaporative)	5,538 ,,
Superheater	2,342 ,,
Combined total	7,880 ,,
Grate area	100 ,,

The engines, which are fitted with Franklin boosters, develop a tractive effort, with the main cylinders alone, of 66,960 lb., and with booster of 81,035 lb., the factor of adhesion being 4·08. In working order each engine weighs 213 tons, and the tender 170 tons 8 cwt., a total of 383 tons 8 cwt., the percentage of this weight available for adhesion being 121 tons 17 cwt. The tender is carried upon two six-wheeled bogies and carries 25 tons of fuel and 22,000 gallons of water.

British Standard Specification for Structural Steel

The British Standards Institution has just published a revised edition of the British Standard Specification for structural steel for bridges and general building construction. The following are the principal modifications which have been made in the new issue :—

(*a*) The division of the material into A and B steel has now been removed.

(*b*) The diameter or thickness of round or square bars, for purposes other than concrete reinforcement, below which tensile tests are not required to be made has been increased from ¼ in. to ⅜ in.

(*c*) The specified elongation for round or square bars under ⅜ in. in diameter or thickness has been reduced from 20 to 16 per cent.

(*d*) The specified elongation for rivet bars has been slightly increased from 25 per cent. to 26 per cent.

(*e*) The number of cold bend tests has been reduced.

(*f*) The rolling margin on thin plates and small bars has been increased and the particulars are now set out in tabular form.

(*g*) The rolling margins on plates below a certain thickness and round and square bars below a certain diameter or side are now required to be ascertained separately from those of larger dimension, the limiting figures being ¼ in. in the case of plates and ⅜ in. in the case of round and square bars.

Copies of this specification (No. 15-1936) may be obtained from the British Standards Institution, 28 Victoria Street, London, S.W.1, price 2s. 2d. post free.

WATT MODEL IN MUNICH MUSEUM.—A facsimile of James Watt's pioneer steam engine is now on view in the Deutsches Museum at Munich. It was made by the German engineer Eugen Loher who constructed the model of Stephenson's Puffing Billy for the same museum. Watt's stationary engine served to drive no fewer than 43 grinding mills during the 70 years of its active work.

WILLIAM DE GUISE FORBES

WE regret to record the death, on February 14, of Lt.-Col. Sir William de Guise Forbes, last General Manager of the former London Brighton & South Coast Railway, from 1899 to 1923. Sir William was born in Dublin in 1856 and educated at Dulwich and King's College, and also in France and Germany. He joined the London Chatham & Dover Railway in 1873, under his famous uncle James Staats Forbes, then Managing Director, and served in various departments until, in 1888, he was appointed Continental Manager. Shortly afterwards he became Traffic Manager, and, when the South Eastern Railway and the London Chatham & Dover Railway joined forces in 1899, he became Assistant General Manager of the combined undertaking. In October, 1899, however, he was appointed General Manager of the L.B. & S.C.R., the position he held until the general railway amalgamation in 1923. Sir William was Chairman of the Railway Clearing House General Managers' Conference in 1909, and during the war he was a member of the Railway Executive Committee. Afterwards he also continued as a member of the Railway Advisory Committee associated with the Ministry of Transport. He was Commandant of the Engineer and Railway Staff Corps and his Knighthood was conferred upon him in 1915. Sir William was also an Officer of the Legion of Honour, an Officer of the Order of Leopold, and a Knight of the Order of Dannebrog.

The late Sir William de Guise Forbes, Kt.,
General Manager, London, Brighton & South Coast Railway, 1899-1923

Outstanding among the works for which Sir William was responsible on the L.B. & S.C.R. were the widening of the main line as far as Balcombe Tunnel, the reconstruction of Victoria station, and above all the inauguration of suburban electrification, which, from the first, was designed with a view to future extension to the coast. His career was also closely connected throughout with improvements in cross-Channel services—culminating in the introduction of 25-knot steamers which completed the Newhaven-Dieppe crossing in 3¼ hours—and also with the introduction of 1-hour services to Brighton—including the Southern Belle—and of third class Pullman cars, the first in this country, in 1915. As stated by Lord Palmer in a speech on November 9 last, Sir William was the father of the Railway Convalescent Homes, of which he was the first President in 1901.

As we recall in an editorial note on page 321, Sir William's family connection with railways extends over nearly a century, for it was in 1838 that his uncle, James Staats Forbes, joined the G.W.R. The latter then had Continental experience as Resident Director and Manager of the Dutch Rhenish Railway before becoming General Manager of the L.C. & D.R. in 1861; this was followed by the unusual British railway office of Managing Director in 1871. Sir William's father—also William Forbes—was Manager of the Midland Great Western Railway of Ireland.

The following is a happy appreciation of Sir William, written by Sir Philip Dawson, M.P., and published in *The Times* on Monday:—

As one who had known Sir William Forbes for over 40 years and who for 25 years was very closely associated with him as electrical adviser, when he was General Manager of the L.B. and S.C. Railway Company, may I be allowed to trespass on your space?

Sir William was one of the pioneers of the electrification of suburban sections of our railways, and after thorough examination, and in the face of great opposition and the ridicule of many of those in charge of the destinies of our railways, he electrified the South London line from Victoria to London Bridge via Denmark Hill. The economic success of this undertaking was instantaneous and resulted in further extensions. As far back as 1905, when Sir William was first considering electrification, he did so with the deliberate intention of extending it to Brighton, Eastbourne, and Hastings, and but for the war and the consequent grouping of the railways, this would have been completed many years ago. The electrification carried out by the Southern Railway up to date is only the execution of proposals formulated by Sir William Forbes long before the War, and the success achieved by the Southern is a proof of his far-sightedness and the soundness of his judgment.

Sir William did much to encourage and foster the *entente cordiale* between France and this country which King Edward VII had so much at heart, and his friendly relations with the French railways and the French Government, both of whom held him in high esteem, were of great service in this direction. All those who served under him from the lowest to the highest had the highest possible regard for him and were proud to give of their best in the interests of the company over whose destinies he presided. He possessed great charm of manner and was a delightful friend and companion, a lover of art and music, himself an accomplished pianist, and he will be greatly missed and deeply mourned by all those who had the privilege of his friendship.

There were few general managers of his period who were so highly esteemed as was Sir William in his personal as well as his official capacity, and a large number of his friends in both spheres paid a last tribute at the funeral on Monday, to which we refer on page 349. In 1902 he married Louise, daughter of M. Tronche of Souillac, France, and had one son. Sir William also leaves a brother, Mr. Stanhope Forbes, R.A., who has designed several well-known railway posters.

RAILWAY NEWS SECTION

PERSONAL

Mr. Charles Carslake, Assistant-Signal and Telegraph Engineer, Southern Area, has been appointed Signal and Telegraph Engineer, North Eastern Area, London & North Eastern Railway. He began his signalling career over 30 years ago with the British Power Railway Signal Co. Ltd. At that time the firm, having completed the first installation in this country of track circuit controlled automatic signals between Andover and Grateley, on the L.S.W.R., and the power operation of points and signals at the latter place, was engaged on similar works at Salisbury, between Woking and Basingstoke and at Staines on the same system. Mr. Carslake was in charge of the electrical side of this work and afterwards went on to the large installation put down by the same firm between Manchester and Newton, at Manchester (London Road), and between Manchester and Godley, on the Great Central Railway. In 1906 he was appointed Assistant Signal Superintendent of the Great Central Railway, a position he held until 1924, when he was appointed Outdoor Assistant to the Signal Engineer, Southern Area, L.N.E.R., with charge of all signal maintenance and new works on the Great Central section. In August, 1926, he was appointed Assistant Signal Engineer for the whole Southern Area. At the time of the reorganisation in April, 1929, Mr. Carslake became Assistant Signal and Telegraph Engineer, the position he now vacates to go to the North Eastern Area as Signal and Telegraph Engineer. Mr. Carslake was closely concerned with many interesting new features in railway signalling on the Great Central Railway, including the push-button hump yard signalling at Wath, and the all-electric operation and first complete installation of upper-quadrant signalling at Keadby. At Quainton Road the first long distance point operation on a main line was installed and it was between Marylebone and Neasden that the first colour-light signal section of a steam-worked railway was introduced. Actually the latter work was carried out by the L.N.E.R. after the grouping, but the scheme was evolved in the days when this was the Great Central Railway. In addition to these pioneer works, the Great Central was second only to the Lancashire & Yorkshire Railway in dividing long block sections by intermediate automatic signals, and it was upon this subject that Mr. Carslake read a paper before the Institution of Railway Signal Engineers in 1922. Of late years he has been closely concerned with the resignalling at King's Cross terminus and at Fenchurch Street, and also with the Gidea Park—Shenfield and finally the Bethnal Green—Enfield re-signalling schemes. Mr. Carslake was Vice-President of the Institution of Railway Signal Engineers in 1931 and in 1932 was elected President of that institution, of which he has been a Member since 1913 and a Member of the Council since 1920. He is also a member of the Institute of Transport.

Mr. C. Carslake,

Appointed Signal and Telegraph Engineer, North Eastern Area, L.N.E.R.

Mr. M. G. Bennett, M.Sc.,

Appointed Lighting and Heating Assistant to the Chief Civil Engineer, L.M.S.R.

Photo by] [Lafayette

Mr. H. W. Moore,

Appointed Divisional Signal and Electrical Engineer, Scottish Division, Glasgow, L.M.S.R.

Mr. Maurice George Bennett, M.Sc., F.Inst.P., who, as announced in our issue of February 14, has been appointed Lighting and Heating Assistant to the Chief Civil Engineer, L.M.S.R. as from January 1 last, took his B.Sc. (hons. Physics) in 1922 at Bristol University and for two years was engaged in wireless research for H.M. Government. In 1924 he obtained his M.Sc. degree. In that year also he returned to Bristol University, where he lectured in physics and also carried out research in visibility for the War Office. In 1930 a Government inter-departmental committee on visibility was formed, and Mr. Bennett was appointed as its Research Officer, with headquarters at Kew Observatory (Meteorological Office). He entered the service of the L.M.S.R. in 1934 as Technical Assistant in the Lighting Section, and in an advisory capacity for the Research Department in regard to Physics. In 1935 the Physics Section of the Research Department was formed, and Mr. Bennett was appointed to take charge of this, which work he continues. Upon the retirement of Mr. A. H. Stevens, the lighting and heating work was combined to form a new section of the Chief Civil Engineer's Department with Mr. Bennett in charge.

Mr. H. W. Moore, who, as announced in our February 14 issue, has been ap-

pointed Divisional Signal and Electrical Engineer, Glasgow, L.M.S.R., joined the former Lancashire & Yorkshire Railway at Horwich, and was subsequently employed as a draughtsman on traction, power and lighting work. He was then transferred to the Telegraph Superintendent's office and took charge of the electrical workshops. Mr. Moore's next appointment was as Electrical Assistant to the Chief Civil Engineer (Signal Section) Manchester, and was followed by his promotion to the position of Telegraph and Electrical Assistant "B" Division, London & North Western Railway, as

Mr. H. E. Cracknell,

District Goods Manager, Cardiff, G.W.R., 1930-36

a result of the 1922 amalgamation. In 1930 he was appointed Outdoor Assistant (Signals) L.M.S.R., Derby, and in March, 1934, was transferred to Euston in a similar capacity, the post he now relinquishes to go to Scotland. Mr. Moore is an Associate Member of the Institution of Electrical Engineers and a Member of the Institution of Railway Signal Engineers, of which he is also a Member of Council: he was, moreover, Lecturer in Electrical Engineering, Mathematics and Applied Mechanics, for a number of years, at the Horwich Railway Mechanics Institute.

Mr. Herbert Elliott Cracknell, who, as announced below, retires from the position of District Goods Manager, Cardiff, G.W.R., on February 22, after six years in this capacity, joined the Great Western service in 1891 in the Horse Department: three years later he was transferred to the Chief Goods Manager's office and remained on his personal staff for about 23 years. In 1915 he was promoted to the position of Chief Clerk to the Bristol District Goods Manager, and in 1922 was appointed Assistant to the Cardiff Valleys District Manager. He was closely associated with the spade-work and bringing into being of the grouping of the South Wales railways. In 1926 he was appointed Assistant to the Cardiff District Goods Manager, and three years later was placed in charge of the Cardiff Valleys District. On January 1, 1930, he took over the goods managership of the Cardiff District, and it is from this position that he now retires. During his tenure of this office the reorganisation of the Cardiff, Cardiff Valleys and Newport Goods Districts was effected, leaving the two areas which exist today, *i.e.* the Cardiff and Newport Districts.

Mr. C. E. Boxall, who, as officially announced this week, has been appointed to the post of District Goods Manager, Cardiff, G.W.R., following the retirement of Mr. H. E. Cracknell, joined the company's service in 1896, at Poplar, where he gained experience in goods and shipping operations. In 1903 he was transferred to the London District Goods Manager's office, and remained there until he joined the Army and went on active service. On his return in 1918, he was appointed to the Chief Goods Manager's office, and three years later was transferred to the Horse Department, serving first as Chief Clerk to the Horse Superintendent, and then as Cartage Superintendent at South Lambeth. In 1923 Mr. Boxall returned to the Chief Goods Manager's office as Chief Clerk to the Development Agent, and in 1928 was appointed Assistant Development Agent. The following year he was transferred to Birmingham as Goods Agent, returning in 1931 to London to take up the position of Goods Superintendent at Paddington. At the end of 1934 he was appointed Assistant District Goods Manager at Cardiff, which post he vacates on his present appointment.

Mr. F. W. Dallow, who, as recorded below, has been appointed to succeed Mr. C. E. Boxall as Assistant District Goods Manager at Cardiff, G.W.R., joined that railway in the Goods Department at Hereford in 1894. He was transferred to Cheltenham Goods in 1901, and to the Gloucester District Goods Manager's office in the following year; in 1918 he went to Bristol. Five years later he returned to the Gloucester District Goods Manager's office as Chief Clerk, and in 1928 took over the duties of Goods Agent at Newport for a few months, before going to Cardiff in a similar capacity.

Central Argentine Railway Appointments

The following staff changes on the Central Argentine Railway are announced by the board of directors:—

Mr. A. S. Matthews to be Stores Superintendent at Rosario.

Major R. K. Hubbard to be Assistant to the General Manager.

Messrs. H. B. Riggall and T. W. Fairhurst have been elected Directors of Ruston and Hornsby Limited. Mr. Riggall was formerly Commercial Manager of the Company, and Mr. Fairhurst, who will act as Sales Director, was with Crompton Parkinson Limited until now.

G.W.R. Appointments

The directors of the Great Western Railway have approved the following appointments:—

Mr. C. E. Boxall, Assistant District Goods Manager, Cardiff, to be District

Mr. C. E. Boxall,

Appointed District Goods Manager, Cardiff, G.W.R.

Goods Manager, Cardiff, as from Mr. H. E. Cracknell's retirement on February 22.

Mr. F. W. Dallow, Goods Agent, Cardiff, to be Assistant District Goods Manager, Cardiff.

Mr. E. W. Lister, Chief Clerk, District Goods Manager's office, Cardiff, to be Goods Agent, Cardiff.

Mr. F. A. Cartwright, Chief Clerk, District Goods Manager's office, Shrewsbury, to be Chief Clerk, District Goods Manager's office, Cardiff.

Mr. W. M. Bryant, Clerk, District Goods Manager's office, Newport, to be Chief Clerk, District Goods Manager's office, Shrewsbury.

Mr. G. H. Crook, Assistant to Signal Engineer, Reading, to be Chief Assistant to Signal Engineer, Reading.

Mr. E. C. Browne, Assistant, Signal Engineer's office, Reading, to be Assistant to Signal Engineer, Reading.

Mr. H. M. Young, Chief Clerk, Signal Engineer's office, Reading, to be Assistant to Signal Engineer (Office and Works), Reading.

Lt.-Col. J. H. M. Greenly, Deputy Chairman of Babcock Wilcox Limited, has been appointed a Director of the Cape Asbestos Co. Ltd.

FIRST ROYAL INVESTITURE

At the first Investiture of King Edward VIII, held at Buckingham Palace on February 18, the King invested the following with insignia of the respective orders to which they have been admitted:—

Knight Commander of the Royal Victorian Order

Sir James Milne, Kt., C.S.I., General Manager, Great Western Railway.

Commanders of the Most Excellent Order of the British Empire

Mr. Francis Robert Edward Davis, O.B.E., Secretary, G.W.R.

Mr. Spencer Pelham Flowerdew, Nyasaland Railways.

SECOND ROYAL INVESTITURE

At King Edward's second Investiture, on February 19, he conferred the honour of Knighthood on the following:—

Mr. Ralph Cope, Chief Accountant, Great Western Railway;

Mr. William Rutton Searle Sharpe, lately Chairman Bombay Port Trust; and

Mr. Lionel Ashton Piers Warner, C.B.E., J.P., General Manager and Secretary, Mersey Docks and Harbour Board.

His Majesty also invested with the insignia of the respective divisions of the Order of the British Empire into which they have been admitted, the following:—

O.B.E.

Mr. John Frederick Lean, Principal Assistant to the General Manager, G.W.R.,

Mr. Libert Oury, Director, Nyasaland, Central Africa and Beira Railways.

M.B.E.

Mr. Ernest John Sutton, Staff Officer, Ministry of Transport.

INSTITUTE OF TRANSPORT

The following members and associate members have been elected during January:—

Members

Mr. W. J. Bubb, Comptroller of Accounts and Audit, New South Wales Government Railways.

Mr. A. W. Mechin, Superintendent (Commercial and Staff) South African Railways and Harbours.

Mr. J. D. White, System Manager, Port Elizabeth, S.A.R. & H.

Associate Members

Messrs. L. Alderman, Pickfords Ltd.; J. W. B. Carter, R. McL. Currie and J. N. de Villiers, S.A.R. & H.; C. W. Chen, Peiping-Mukden Section, Chinese National Railways; G. S. Kellow, J. Lorimer, L. Meara and J. Storey, L.N.E.R.; C. A. O'Shea, New South Wales Government Railways; and H. C. L. Trickett, Southern Railway.

At a farewell dinner at York, on February 14, to Mr. H. Gent—who, as already recorded in these columns, has just retired from the position of Hotels Superintendent, North Eastern Area, L.N.E.R.—Mr. T. Hornsby, Divisional General Manager, presided, and on behalf of brother officers, presented Mr. Gent with a radiogram, as a token of appreciation of his long service and of happy associations with him.

Mr. J. E. Roberts has been appointed General Traffic Manager, Delaware & Hudson Railroad, as from February 1.

Sir Felix J. C. Pole, Chairman, Associated Electrical Industries Limited, returned last week from his visit to Brazil.

COLONIAL OFFICE APPOINTMENTS

Mr. W. A. Smyth, Deputy Mechanical Engineer, Ceylon Government Railway, has been promoted Mechanical Engineer, and is succeeded as Deputy Mechanical Engineer by Mr. H. W. F. Freer, formerly Senior Assistant Mechanical Engineer.

SUPERVISORY BOARD, GERMAN STATE RAILWAY

At a meeting of the preference shareholders of the German State Railway Company, held on January 13, 1936, Herr Staatsrat Friedrich Reinhart, a banker, was selected as their representative on the board, to fill the vacancy caused by the death on September 25, 1935, of Dr. Bergmann, a former Secretary of State.

The funeral of Mr. T. R. Smith, Secretary of the Cheshire Lines Committee, whose death we announced last week, took place at Allerton cemetery on Saturday. Among those present were:—

Messrs. G. Leedam, Acting Manager, K. C. Marrian, Resident Engineer, and K. W. Doughty, Accountant, of the C.L.C.; Messrs. F. W. Wheddon (representing Sir Ralph Wedgwood and Mr. C. H. Newton), W. H. Johnson (representing Mr. J. McLaren), E. Coleby (representing Mr. I. B. Pritchard), and A. Oldham, Assistant Divisional General Manager, all of the L.N.E.R.; and Messrs. C. Johnstone and F. R. Hauxwell, representing L.M.S. members of the C.L.C.

INDIAN RAILWAY STAFF CHANGES

Mr. C. A. K. Bradley has been appointed to officiate as Deputy Chief Mechanical Engineer (Workshops), E.B.R., as from December 24.

Rai Bahadur P. L. Dhawan has been confirmed as Chief Engineer, State Railways, as from October 15 last.

Mr. H. N. Joscelyne has been promoted provisional permanent Chief Engineer, State Railways, from October 15, and retains his post of officiating Senior Government Inspector.

Mr. E. L. Manley has been confirmed provisionally as Chief Engineer, E.B.R., as from December 31.

Mr. A. Cornish has been appointed to officiate as Deputy Chief Operating Superintendent, N.W.R., as from November 30.

Mr. F. F. Parish has been appointed to officiate as Deputy Chief Accounts Officer, G.I.P.R., as from January 10.

Mr. R. Mair, Officiating Deputy Agent (Organisation) E.I.R. has been granted 9 months' leave as from January 23.

FUNERAL OF SIR WILLIAM FORBES

The funeral took place at St. Mark's Church, Hamilton Terrace, St. John's Wood, on Monday, February 17. The Rev. A. H. Morris and the Rev. G. C. Gilson officiated. Besides the family mourners, the large congregation present included:—

The Roumanian Minister; Comte J. Tillette de Clermont-Tonnerre (Correspondent of the Chemin de fer du Nord); M. Etienne Hauterre (French State Railways); Lord Ashfield; Lord Palmer of Reading; Sir Guy Granet; Sir Sam Fay; Sir Philip Dawson. The Southern Railway Company was represented by Sir Charles L. Morgan, Director; Sir Herbert Walker, General Manager; Colonel Gilbert S. Szlumper, Assistant General Manager; Mr. F. H. Willis, Secretary; Mr. William Bishop, Solicitor; Mr. Edwin C. Cox, Traffic Manager; and the following past and present officers of the company:—Messrs. C. H. Barfoot, L. Billinton, C. Chalk, Charles Cooper, O. G. Drury, G. H. Hare Dean, A. E. Moore, W. G. Pape, E. A. Scanes, H. A. Sire.

The Pullman Car Co. Ltd. was represented by Mr. Ernest Ashton, and Lord Hirst was represented by Mr. W. Lewis Smith. There were also present:—Mr. Albert O. Peech (United Steel Companies); Mr. W. W. Legg, representing Mr. J. A. Kay, Editor, THE RAILWAY GAZETTE; Mr. Charles Dent; Mr. George Terrell; Mr. Alec Sandberg and Mr. Peter Sandberg.

Mr. F. H. Holland, Consulting Production Engineer of London, is to join the board of directors of Webster & Bennett Limited, Coventry, on April 1. Mr. Holland will thus become a permanent member of the staff of that firm and will be Director responsible for planning and production.

Mr. Herbert M. Gibson will relinquish his appointment as General Manager of the Manchester Ship Canal on February 29, but will be retained in a consultative capacity. The directors desire to record their high appreciation of his valuable services to the company extending over a period of 44 years. Mr. Leslie Roberts, at present Deputy General Manager, will succeed Mr. Gibson as General Manager on March 1.

Sir Josiah and Lady Stamp gave a dinner party on Friday at the Langham Hotel in honour of General Carl Vaugoin, ex-Chancellor of Austria and President of the Austrian Federal Railways, and Mme. Vaugoin. The guests included:—

Herr L. Von Blaas, Austrian Chargé d'Affaires, Herr and Frau Direcktor Emerich Karner. Count Hans Huyn, Lord Ashfield, Sir Harold and Lady Bellman, Lady Hartley, Sir Cyril and Lady Hurcomb, Mr. Maurice Kestenbaum, Mr. E. J. H. Lemon, Sir James and Lady Milne, Sir Herbert and Lady Walker, Sir Ralph and Lady Wedgwood, and Mr. and Mrs. W. V. Wood.

THE BRITISH INDUSTRIES FAIR, BIRMINGHAM.—On February 14 a special press visit was arranged to the Engineering and Hardware Section of the British Industries Fair at Castle Bromwich, Birmingham. The gathering, which was the largest ever held in connection with the fair, was attended by some three hundred representatives of home, empire, and foreign newspapers.

Railway Speeds in 1935

2.—North America

By CECIL J. ALLEN, M.Inst.T.

The development of high speeds on the railways of the United States during the past five years has been one of the most remarkable railway operating phenomena on record. At the end of 1930 the total number of runs on the North American Continent scheduled at 60 m.p.h. and over from start-to-stop was 29, and their total length 1,106 miles; two years later the number had increased to 51 and the mileage to 2,672, to which Canada contributed 8 runs totalling 650 miles; by the end of 1935 the aggregate at 60 m.p.h. and over has swept up to the immense total of 413 runs, and the distance to 19,279 miles. Curiously enough, the United States is now concerned alone, or practically so; from the zenith of the Canadian National *versus* Canadian Pacific competition for the Montreal-Toronto traffic, which resulted finally in the establishment of what were at the end of 1932 the fastest booked runs in the world—108 min. over the 124·0 miles from Montreal West to Smith's Falls, C.P.R., and 109 min. in the reverse direction, calling for start-to-stop speeds of 68·9 and 68·3 m.p.h. respectively—the slowing down which has followed the pooling of this traffic results in only one mile-a-minute run now being found in the Canadian time-tables.

One of the principal factors in this winter's increase in American high speed mileage over last year has been the speed-up of the entire electrified train service of the Pennsylvania, which took place in October last, between New York, Philadelphia, Baltimore, and Washington. Over the densely occupied main lines between New York and North Philadelphia, used by 112 express trains daily, as well as many other fast and local services, the Pennsylvania is now demonstrating the speed possibilities of electric traction in a most striking fashion. The hourly local trains between New York and Broad Street, Philadelphia, all stopping at Manhattan Transfer and Newark at one end, and North Philadelphia and 30th Street, at the other end of the journey, as well as intermediately at Trenton, are allowed from 71 to 73 min. to run the 75·9 miles between Newark and North Philadelphia, including the Trenton stop, and, generally, one or two others as well; the entire 91·5 miles from terminal to terminal occupy from 100 to 104 min. Of the long-distance trains, the Congressional makes the highest speed over this stretch, running from Newark to North Philadelphia in 66 min., at 69 m.p.h. start-to-stop, and completing the entire journey of 224·6 miles between New York and Washington, with six intermediate stops in each direction, in 225 min.,

TABLE A—AMERICAN RAILWAY RUNS BOOKED FROM START TO STOP AT SPEEDS OF 62 M.P.H. AND OVER WINTER, 1935 1936.

Train No.	Name of Train.	From	To	Distance.	Time.	Speed.
	Pennsylvania Steam Services (24 runs).			Miles.	Min.	m.p.h.
208	Union	Valparaiso	Plymouth	40·3	32	75·6
4	Detroit Arrow	Plymouth	Fort Wayne	64·1	51	75·4
7	Detroit Arrow	Fort Wayne	Gary	123·0	99	74·5
208	Union	Gary	Valparaiso	18·6	15	74·4
208	Union	Plymouth	Fort Wayne	64·1	52	74·0
4	Detroit Arrow	Gary	Plymouth	58·9	48	73·6
207	Union	Fort Wayne	Plymouth	64·1	53	72·6
207	Union	Plymouth	Valparaiso	40·3	34	71·1
58	Liberty Limited	Gary	Plymouth	58·9	51	69·3
78	Golden Arrow	Gary	Plymouth	58·9	51	69·3
29	Broadway Limited	Fort Wayne	Englewood	140·9	124	68·2
28	Broadway Limited	Englewood	Fort Wayne	140·9	124	68·2
59	Liberty Limited	Fort Wayne	Plymouth	64·1	57	67·5
58	Liberty Limited	Plymouth	Fort Wayne	64·1	57	67·5
78	Golden Arrow	Plymouth	Fort Wayne	64·1	58	66·3
29	Broadway Limited	Crestline	Fort Wayne	131·7	†121	65·3
54	Gotham Limited	Gary	Fort Wayne	123·0	115	64·2
5	Pennsylvania Limited	Fort Wayne	Plymouth	64·1	60	64·1
28	Broadway Limited	Fort Wayne	Crestline	131·7	†124	63·7
30	Spirit of St. Louis	Effingham	Terre Haute	67·9	64	63·7
44	Fort Dearborn	Englewood	Fort Wayne	140·9	134	63·1
200	Southland	Valparaiso	Fort Wayne	104·4	101	62·0
79	Golden Arrow	Plymouth	Valparaiso	40·3	39	62·0
52	New Yorker	Valparaiso	Plymouth	40·3	39	62·0
	Pennsylvania Electric Services (64 runs).					
131	Congressional	Newark	North Philadelphia	75·9	66	69·0
216	1 run	Princeton Junction	Elizabeth	32·9	29	68·1
152	Congressional	North Philadelphia	Newark	75·9	67	68·0
29	Broadway Limited	Newark	North Philadelphia	75·9	69	66·0
176	Senator	North Philadelphia	Newark	75·9	69	66·0
—	4 runs	Newark	Princeton Junction	38·3	35	65·7
210	1 run	Trenton	Elizabeth	42·6	39	65·5
—	6 runs	Newark	Trenton	48·0	44	65·5
28	Broadway Limited	North Philadelphia	Newark	75·9	70	65·1
152	Congressional	Baltimore	Wilmington	68·5	64	64·2
31	Spirit of St. Louis	Newark	North Philadelphia	75·9	71	64·2
—	1 run	North Philadelphia	Trenton	27·8	26	64·2
—	6 runs	Trenton	Newark	48·0	45	64·0
—	2 runs	Trenton	Elizabeth	42·6	40	63·9
—	5 runs	Princeton Junction	Newark	38·3	36	63·8
—	1 run	Elizabeth	Princeton Junction	32·9	31	63·7
—	2 runs	Trenton	New Brunswick	25·4	24	63·5
177	Senator	Newark	North Philadelphia	75·9	72	63·3
—	2 runs	Wilmington	Baltimore	68·5	65	63·2
—	2 runs	Baltimore	Wilmington	68·5	65	63·2
—	2 runs	Princeton Junction	New Brunswick	15·7	15	62·8
—	2 runs	New Brunswick	Princeton Junction	15·7	15	62·8
—	2 runs	Newark	Trenton	48·0	46	62·6
—	4 runs	Trenton	Newark	48·0	46	62·6
61	Pittsburgher	Newark	North Philadelphia	75·9	73	62·4
54	Gotham Limited	North Philadelphia	Newark	75·9	73	62·4
—	2 runs	Trenton	Elizabeth	42·6	41	62·3
—	2 runs	Elizabeth	Trenton	42·6	41	62·3
—	2 runs	Wilmington	Baltimore	68·5	66	62·2
—	4 runs	Baltimore	Wilmington	68·5	66	62·2
—	1 run	Princeton Junction	Newark	38·3	37	62·1
	Chicago, North Shore and Milwaukee Electric Services (28 runs).			Miles.	Min.	m.p.h
—	Prairie State Special	Kenosha	Waukegan	15·0	12	75·0
—	Chicago Limited	Kenosha	Zion	8·7	7	74·6
—	2 runs	Kenosha	Waukegan	15·0	13	69·2
—	3 runs	Racine	Kenosha	10·0	9	66·7
—	3 runs	North Chicago Jct.	Niles Centre	27·0	25	64·8
—	2 runs	Waukegan	Kenosha	15·0	14	64·3
—	1 run	Harrison	Racine	20·1	19	63·5
—	12 runs	North Chicago Jct.	Niles Centre	21·0	20	63·0
—	1 run	Zion	Waukegan	6·3	6	63·0
—	2 runs	Howard St.	North Chicago Jct.	27·0	26	62·3
	Reading and Pennsylvania–Reading Seashore Lines (7 runs).					
1021	1 run	Haddonfield	Absecon	45·3	40	68·0
1029	1 run	Haddonfield	Atlantic City	51·4	48	64·3
602	Wall Street Special	Jenkintown	Jersey City	79·4	76	62·7
602, 620	2 runs	Jenkintown	West Trenton	21·7	21	62·0
603, 623	2 runs	West Trenton	Jenkintown	21·7	21	62·0
	New York, New Haven and Hartford Diesel Services (12 runs).					
—	Comet (6 runs)	Back Bay (Boston)	Pawtucket	38·1	34	67·2
—	Comet (6 runs)	Pawtucket	Back Bay (Boston)	38·1	34	67·2
	Boston and Maine Diesel Services (1 run).					
—	Flying Yankee	Dover	Portland	45·0	43	62·8
	Baltimore and Ohio (4 runs).					
28	Royal Blue	Wayne Junction	Plainfield	62·1	57	65·4
27	Royal Blue	Plainfield	Wayne Junction	62·1	58	64·4
523	Columbian	Plainfield	Wayne Junction	62·1	58	64·4
504	Columbian	Wayne Junction	Plainfield	62·1	60	62·1
	New York Central (8 runs).					
25	Twentieth Century Limited	Toledo	Elkhart	133·0	117	68·2
26	Twentieth Century Limited	Elkhart	Toledo	133·0	120	66·5
68	Commodore Vanderbilt	Elkhart	Toledo	133·0	123	64·6
21	Cleveland Limited	Erie	Ashtabula	40·8	38	64·4
19	Lake Shore Limited	Toledo	Goshen	123·1	115	64·2

† Includes 5 min. stop at coal stage.

TABLE A—(*continued*)

Train No.	Name of Train.	From	To	Distance.	Time.	Speed.
	New York Central (8 *runs*)—(contd).			Miles.	Min.	m.p.h.
26	Twentieth Century Limited	Englewood	Elkhart	93·9	89	63·3
609	Prairie State	Toledo	Elkhart	133·0	127	62·8
142	Mohawk	Ashtabula	Erie	40·8	39	62·8
	Big Four (N.Y.C.) (6 *runs*).					
104	New York Special	Columbus	Galion	58·2	54	64·7
24	Knickerbocker	Muncie	Sidney	65·8	61	64·7
35	Columbus-Cincinnati Special	Wellington	Crestline	39·2	37	63·6
124	Knickerbocker	Galion	Linndale	73·8	70	63·3
24	Knickerbocker	Hillsboro'	Pana	27·3	26	63·0
16	Ohio State Limited	Columbus	Galion	58·2	56	62·4
	Michigan Central (N.Y.C.) (4 *runs*).					
26	Twilight Limited	Niles	Kalamazoo	48·6	46	63·4
10	New York Limited	Essex	Ridgetown	51·5	49	63·1
8	Wolverine	Windsor	St. Thomas	109·6	105	62·6
25	Twilight Limited	Kalamazoo	Niles	48·6	47	62·0
	Chicago, Milwaukee, St. Paul and Pacific (13 *runs*).					
100	Hiawatha	New Lisbon	Portage	43·1	35	73·9
101	Hiawatha	Portage	New Lisbon	43·1	36	71·8
100	Hiawatha	La Crosse	New Lisbon	59·8	51	70·4
101	Hiawatha	New Lisbon	La Crosse	59·8	51	70·4
100	Hiawatha	Milwaukee	Chicago	85·0	75	68·0
101	Hiawatha	Chicago	Milwaukee	85·0	75	68·0
100	Hiawatha	Portage	Milwaukee	92·9	84	66·4
101	Hiawatha	Milwaukee	Portage	92·9	84	66·4
101	Hiawatha	Winona	Red Wing	62·4	58	64·6
23	Chicago-Madison	Chicago	Milwaukee	85·0	80	63·8
28	Milwaukee-Chicago	Milwaukee	Chicago	85·0	80	63·8
56	Fast Mail	Sturtevant	Deerfield	37·6	36	62·7
100	Hiawatha	Red Wing	Winona	62·4	60	62·4
	Illinois Central (5 *runs*).					
20	Daylight	Clinton	Gibson City	38·6	36	64·3
19	Daylight	Kankakee	Clinton	92·7	87	63·9
22	Michigan Boulevard	Clinton	Kankakee	92·7	‡87	63·9
20	Daylight	Gibson City	Kankakee	54·1	51	63·7
21	Michigan Boulevard	Chicago 63rd St.	Clinton	140·6	‡135	62·5
	Chicago and Eastern Illinois (2 *runs*).					
21	Century of Progress	Chicago Heights	Watseka	50·9	48	63·3
22	Century of Progress	Watseka	Chicago Heights	50·9	48	63·6
	Chicago, Burlington and Quincy Diesel Services (23 *runs*).					
21, 23	Zephyr (2 runs)	East Dubuque	Prairie du Chien	54·6	44	74·5
22, 24	Zephyr (2 runs)	North la Crosse	Prairie du Chien	61·4	50	73·7
22, 24	Zephyr (2 runs)	St. Paul	Miner	102·4	88	69·8
21, 23	Zephyr (2 runs)	North la Crosse	Miner	26·7	23	69·7
21, 23	Zephyr (2 runs)	Aurora	Savanna	107·8	93	69·5
22, 24	Zephyr (2 runs)	Prairie du Chien	East Dubuque	54·6	48	68·3
21, 23	Zephyr (2 runs)	Prairie du Chien	North la Crosse	61·4	55	67·0
24	Afternoon Zephyr	Savanna	Aurora	107·8	99	65·3
21	Burlington Zephyr	St. Joseph	Langdon	61·8	57	65·1
21, 23	Zephyr (2 runs)	Chicago	Aurora	37·8	35	64·8
22	Morning Zephyr	Savanna	Aurora	107·8	100	64·7
22, 24	Zephyr (2 runs)	Miner	North la Crosse	26·7	25	64·1
21, 23	Zephyr (2 runs)	Savanna	East Dubuque	39·4	38	62·2
	Chicago and North Western (7 *daily runs*).					
401	The 400	Chicago	Milwaukee	85·0	75	68·0
400	The 400	Milwaukee	Chicago	85·0	75	68·0
151	Pacemaker	Evanston	Kenosha	39·6	36	66·0
401	The 400	South Beaver Dam	Adams	61·4	56	65·8
400	The 400	Adams	South Beaver Dam	61·4	57	64·6
401	The 400	Adams	Eau Claire	113·7	107	63·8
2	City of Portland*	Cedar Rapids	Clinton	81·3	77	63·4
400	The 400	Eau Claire	Adams	113·7	108	63·2
1	City of Portland*	Chicago	Clinton	138·1	132	62·8
1	City of Portland*	Clinton	Cedar Rapids	81·3	78	62·6
	Union Pacific (4 *daily runs*).					
2	City of Portland*	Cheyenne	Omaha	507·0	450	‖67·6
105	Streamliner	Lawrence	Topeka	28·4	26	‖65·5
106	Streamliner	Topeka	Lawrence	28·4	26	‖65·5
1	City of Portland*	Omaha	Cheyenne	507·0	465	‖65·4
99	Streamliner	Topeka	Wamego	36·7	35	‖62·9
12	Columbine	Brighton	La Salle	28·0	27	62·2

* Diesel-operated express, runs on intermittent dates. ‖ Diesel-operated trains. ‡ Includes conditional stops.

or practically at 60 m.p.h. throughout. By a considerable margin the 135 runs at 60 m.p.h. and over of Pennsylvania electric trains, totalling 5,794 miles, is the largest individual mileage item in Table B.

Not only so, but the Pennsylvania takes the premier position in high speed steam mileage, and this is the more remarkable in that, with the suitable portions of line for fast running in the Eastern States all now given over to electric haulage, the only remaining section of the main line adapted for the purpose is the 272·6 miles from Crestline to Englewood, on the outskirts of Chicago. Intervening between the electrified stretch from New York to Paoli (Philadelphia), and the flat country west of Crestline, *en route* from New York to Chicago by the Pennsylvania, there come many miles of heavy grades and much sharp curvature through the Alleghenies, culminating in the summit at Gallitzin, 2,193 ft. above sea-level, just to the west of Altoona, over which all Pennsylvania expresses from New York, Philadelphia, and Washington to Chicago and other cities of the Middle West, including the Broadway Limited, must be worked. Time so lost is recouped west of Crestline, and particularly over the 140·9 miles between Fort Wayne and Englewood, where the five fastest steam-hauled runs in the world are operated, ranging in speed from 74·0 up to 75·6 m.p.h from start to stop. Eight runs in all are timed over this section at more than 70 m.p.h. from start-to-stop.

The nine principal schedules between Fort Wayne and Englewood are, indeed, of so remarkable a description that they are set out separately in Tables C and D, with the average point-to-point speeds incorporated. The Union (Chicago-Cincinnati) and Detroit Arrow (Chicago-Detroit) make the highest speeds; it will be seen that the journeys of these trains provide three runs over the 123·0 miles between Fort Wayne and Gary in 99 min. (74·5 m.p.h.), two of which include a regular intermediate stop, at Plymouth, and one of these a conditional stop at Valparaiso in addition. No allowance is made in running for these stops. The trains concerned are usually four-car and five-car formations of about 300 to 375 tons weight ordinary stock and ordinary "K5" class Pacifics are used, without any streamlining or other special preparation. Apart from a rise of four miles averaging 1 in 245 out of Fort Wayne, the gradients are inconsiderable, being mostly between 1 in 345 and 1 in 440. It will also be noted that heavy expresses such as the Broadway Limited and Liberty Limited have start-to-stop timings over this section as fast as 68·2 to 69·3 m.p.h. Between Fort Wayne and Crestline the schedules are in reality faster than they appear on paper, as they include a stop of about 5 min. duration at the overhead coaling plant between Fort Wayne and Adams, for the engines to be coaled; and there are also several service slacks over this section. Deducting the time spent over the 6·7 miles between Fort Wayne junction and Adams, the running time of the Broadway Limited in both directions over the remaining 265·9 miles between Crestline and Englewood is 232 min., which demands an average speed of 68·8 m.p.h throughout.

The New York Central, with its subsidiaries—the Michigan Central and the "Big Four" (Cleveland, Cincinnati, Chicago and St. Louis)—takes second place in total high-speed mileage, and the individual runs are headed by those of the accelerated Twentieth Century Limited, which is booked over

TABLE B—DAILY START-TO-STOP RUNS BOOKED AT 60 M.P.H. AND OVER IN NORTH AMERICA, WINTER, 1935–36

Railway	70 m.p.h. and over	68 m.p.h. and over	66 m.p.h. and over	64 m.p.h. and over	62 m.p.h. and over	60 m.p.h. and over
	Miles	Miles	Miles	Miles	Miles	Miles
Pennsylvania (Steam) ..	473 (8)	873 (12)	1,065 (15)	1,384 (18)	1,910 (24)	2,565 (36)
,, (Electric)..	—	185 (3)	337 (5)	1,356 (26)	3,189 (64)	5,794 (135)
Pennsylvania Total ..	473 (8)	1,058 (15)	1,402 (20)	2,740 (44)	5,099 (88)	8,359 (171)
New York Central ..	—	133 (1)	266 (2)	563 (5)	831 (8)	2,068 (18)
Big Four	—	—	—	124 (2)	322 (6)	643 (16)
Michigan Central ..	—	—	—	—	210 (3)	405 (7)
New York Central Total	—	133 (1)	266 (2)	687 (7)	1,363 (17)	3,116 (41)
C.N.S. & M. (Electric) ..	24 (2)	54 (4)	84 (7)	195 (12)	527 (28)	1,677 (90)
C.B. & Q. (Diesel) ..	232 (4)	815 (12)	938 (14)	1,344 (21)	1,423 (23)	1,628 (25)
C.M. St. P. & P. ..	206 (4)	376 (6)	562 (8)	626 (9)	896 (13)	1,025 (20)
Baltimore and Ohio ..	—	—	—	186 (3)	248 (4)	760 (12)
C. & N.W.	—	170 (2)	210 (3)	332 (5)	560 (7)	646 (9)
Reading	—	45 (1)	45 (1)	97 (2)	263 (7)	632 (16)
Illinois Central	—	—	—	39 (1)	419 (5)	512 (7)
N.Y.N.H. & H. (Diesel)	—	—	457 (12)	457 (12)	457 (12)	457 (12)
Boston and Maine (Diesel)	—	—	—	—	45 (1)	254 (5)
Other Railways	—	—	—	—	130 (3)	213 (5)
Steam Totals ..	679 (12)	1,597 (22)	2,148 (29)	3,351 (45)	5,889 (80)	9,469 (146)
Electric Totals ..	24 (2)	239 (7)	421 (12)	1,551 (38)	3,716 (92)	7,471 (225)
Diesel Totals ..	232 (4)	815 (12)	1,395 (26)	1,801 (33)	1,925 (36)	2,339 (42)
American Totals ..	935 (18)	2,651 (41)	3,964 (67)	6,703 (116)	11,530 (208)	19,279 (413)

NOTE.—The figures in brackets in each column indicate the number of runs making up each aggregate mileage.

the 133·0 miles from Toledo to Elkhart at 68·2 m.p.h., and in the opposite direction at 66·5 m.p.h. Over the entire 819 miles from Chicago to Albany, including the stops at Englewood, Elkhart, Toledo, C. & P. Crossing (Cleveland), Buffalo, and Syracuse, the Twentieth Century Limited is worked at an inclusive average of 60·6 m.p.h., though normally a train of over 1,000 tons weight, and in the reverse direction the 718·4 miles from Albany to Elkhart, stops included, are covered at 60·2 m.p.h.

The density of the traffic radiating from the Middle West city of Chicago, coupled with the flatness of the country in all directions from this centre, helps to explain why much of the fastest running performed over American metals takes place over various routes focussed on this city. Much has already appeared in THE RAILWAY GAZETTE concerning the three competing routes between Chicago and the Twin Cities of St. Paul and Minneapolis — the Chicago, Burlington & Quincy, Chicago, Milwaukee, St. Paul & Pacific, and the Chicago & North Western—all of which have established 6½-hr. services in both directions between Chicago and St. Paul, the first over a 431-mile route, the second over 410 miles, and the third over 396 miles, all stops included. These competing expresses—the Zephyrs of the C.B. & Q., each of which does the round trip daily of 882 miles from Chicago to Minneapolis and back, or *vice versa*, the Hiawatha of the C.M.St.P. & P., and The 400 of the C. & N.W.—are responsible for most of the high speed mileage of each of these three companies that finds its way into these tables.

Of all the schedules concerned, that of the Hiawatha is the most interesting, and is separately set out in Table E. Actually its fastest stretch is over the 43·1 miles between Portage and New Lisbon, booked eastbound at 73·9 m.p.h., and westbound at 71·8 m.p.h. start to stop. The 59·8 miles between Lisbon and La Crosse are also scheduled to be covered at 70·4 m.p.h. in each direction. But with due allowance for the slow running through the city limits of Chicago and Milwaukee, including three slacks for opening bridges over waterways in the suburbs of Milwaukee, the fastest travelling of all is required over this section of the journey, one stretch of 12 miles being actually booked at 90 m.p.h. pass-to-pass. For the 41·5 miles between Tower A.20 and Sturtevant the average speed demanded of the locomotives is 88·9 m.p.h., and this is with little question the fastest timing ever yet set down seriously in a timetable for observance by a steam locomotive. Various speed restrictions lower the average speeds over other portions of the route, but scrutiny of a record taken from the self-recording indicator of one of the streamlined Atlantic locomotives used shows that, where speed is unrestricted, it normally rules between 80 and 90 m.p.h., except between Chicago and Milwaukee, where it rises to 95 and occasionally reaches and slightly exceeds 100 m.p.h. The two Burlington Zephyrs make the principal contribution to high speed diesel runs in the United States, and all the mileage of the Burlington company figuring in the table is performed with diesel units.

In addition to the steam and diesel competition up the west side of Lake Michigan, electricity provides another competitor between Chicago and Milwaukee over the lines of the Chicago, North Shore & Milwaukee road. This remarkable inter-urban railway enters both cities over street tramway routes, but intermediately runs one of the fastest electrically-operated services in the world—probably, indeed, the fastest—with dining and parlour cars attached to the trains. It is responsible in all for 90 runs, none of greater length than 27 miles, varying in speed from 60

TABLE C—PENNSYLVANIA SCHEDULES: FORT WAYNE—ENGLEWOOD

Distance	Train No. .. .. / Name		59 Liberty Limited	29 Broadway Limited	207 Union	7 Detroit Arrow
Miles			a.m.	a.m.	p.m.	p.m.
0·0	FORT WAYNE	dep.	5 58	6 39	5 25	5 55
1·4	*Junction* ..	pass	6 01	6 42	5 27	5 57
			(63·9)	(63·9)	(72·4)	(72·4)
19·5	Vandale ..	,,	6 18	6 59	5 42	6 12
			(78·0)	(73·1)	(78·0)	(78·0)
39·0	Warsaw ..	,,	6 33	7 15	5 57	6 27
			(68·5)	(75·3)	(71·7)	(79·3)
64·1	Plymouth ..	arr.	6 55	pass	6 18	pass
		dep.	6 55	7 35	6 18	6 46
			(56·4)	(84·6)	(76·9)	(84·6)
78·2	Hamlet ..	pass	7 10	7 45	6 29	6 56
			(68·4)	(73·3)	(78·9)	(73·3)
95·3	Wanatah ..	,,	7 25	7 59	7 42	7 10
			(67·5)	(71·1)	(54·6)	(71·1)
104·4	Valparaiso ..	arr.	—	—	6 52	—
		dep.	—	—	6 52	—
					(61·8)	
117·8	Liverpool ..	pass	7 45	8 18	7 05	7 29
			(62·4)	(60·0)	(44·6)	(62·4)
123·0	Gary ..	arr.	7 53	—	7 12	7 34
		dep.	7 53	—	7 12	7 34
125·8	*Clarke Junc.*	,,	7 56	8 26	7 15	7 37
134·7	*River Branch Junction* ..	,,	8 06	8 35	7 24	7 46
140·9	ENGLEWOOD	arr.	8 13	8 43	7 32	7 54

NOTE.—The figures in brackets indicate average speed between passing points.

TABLE D—PENNSYLVANIA SCHEDULES: ENGLEWOOD (CHICAGO)—FORT WAYNE

Distance	Train No. .. .. / Name		78 Golden Arrow	208 Union	58 Liberty Limited	28 Broadway Limited	4 Detroit Arrow
Miles			p.m.	p.m.	p.m.	p.m.	p.m.
0·0	ENGLEWOOD ..	dep.	12 45	1 45	2 45	3 45	4 25
6·2	*River Branch Jc.*..	pass	12 54	1 54	2 54	3 54	4 34
15·1	*Clarke Junction* ..	,,	1 03	2 03	3 03	4 03	4 43
			(62·4)	(62·4)	(44·6)	(68·6)	(62·4)
17·9	Gary	arr.	1 06	2 06	3 06	—	4 46
		dep.	1 06	2 06	3 06	—	4 46
23·1	Liverpool ..	pass	1 11	2 11	3 13	4 10	4 51
				(80·4)			
36·5	Valparaiso ..	arr.	—	*2 21	—	—	—
		dep.	—	2 21	—	—	—
			(71·1)	(68·3)	(75·0)	(71·1)	(75·0)
45·6	Wanatah ..	pass	1 30	2 29	3 31	4 29	5 09
			(73·3)	(73·3)	(73·3)	(73·3)	(73·3)
62·7	Hamlet	,,	1 44	2 43	3 45	4 43	5 23
			(65·1)	(84·6)	(70·5)	(76·9)	(76·9)
76·8	Plymouth ..	arr.	1 57	2 53	3 57	pass	5 34
		dep.	1 57	2 53	3 57	4 54	5 34
			(65·5)	(79·3)	(71·7)	(75·3)	(75·3)
101·9	Warsaw	pass	2 20	3 12	4 18	5 14	5 54
			(68·8)	(78·0)	(68·8)	(68·8)	(78·0)
121·4	Vandale	,,	2 37	3 27	4 35	5 31	6 09
			(72·4)	(72·4)	(67·9)	(67·9)	(77·6)
139·5	*Junction*	,,	2 52	3 42	4 51	5 47	6 23
140·9	FORT WAYNE..	arr.	2 55	3 45	4 54	5 49	6 25

* Stops when required.

NOTE.—The figures in brackets indicate average speed between passing points.

up to 75 m.p.h. from start to stop. That these are by no means merely paper timings, also, is proved by the tact that the C.N.S. & M. has on several occasions won a trophy presented to the railway with the best punctuality records over a complete year.

Apart from the lines already mentioned, and, of course, the competing services of the Pennsylvania and New York Central between Chicago and New York, other competition has resulted in the speeding up of the Chicago-Detroit, Chicago - Cincinnati, and stops, the C. & E.I. with the Century of Progress, travelling 290·4 miles and making eight stops, the Alton with the Abraham Lincoln, on a 283·9-mile route with three stops and the Wabash with the Banner Blue Limited, covering 285·7 miles, and making only one stop—at Decatur—between Englewood, outside Chicago, and Delmar Boulevard at St. Louis. The 165·9 miles from Englewood to Decatur are run by the Banner Blue in 169 min., the run so falling just beyond the scope of the table, but various of the runs made

TABLE E—CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC R.R.—THE HIAWATHA SCHEDULE

Distance	Direction	Westbound				Eastbound		
		Schedule	Average Speeds			Schedule	Average Speeds	
Miles		p.m.	m.p.h.	m.p.h.*		p.m.	m.p.h.	m.p.h.*
0·0	CHICAGO .. .. dep.	1 00	—		arr.	7 30	24·9	
5·4	*Pacific Junction* pass	1 09	36·0		pass	7 17	68·8	
20·3	*Tower A. 20* .. .. ,,	1 22	68·8		,,	7 04	90·0	
32·3	Rondout .. .. ,,	1 30	90·0	68·0	,,	6 56	88·5	68·0
61·8	Sturtevant .. .. ,,	1 50	88·5		,,	6 36	73·3	
83·9	Washington St. .. ,,	2 09	69·2		,,	6 18	22·0	
85·0	arr.	2 15	11·0		dep.	6 15	—	
0·0	MILWAUKEE .. dep.	2 17	—		arr.	6 10	44·8	
14·2	Brookfield .. .. pass	2 34	50·1		pass	5 51	80·2	
24·9	Hartland .. .. ,,	2 44	64·2		,,	5 43	59·3	
32·8	Oconomowoc .. .. ,,	2 50	79·0	66·4	,,	5 35	72·0	66·4
46·0	Watertown .. .. ,,	3 01	72·0		,,	5 24	78·8	
77·5	East Rio .. .. ,,	3 27	72·7		,,	5 00	66·0	
92·9	arr.	3 41	66·0		dep.	4 46	—	
0·0	Portage .. .. dep.	3 42	—	71·8	arr.	4 45	73·9	3·9
43·1	arr.	4 18	71·8		dep.	4 10	—	
0·0	New Lisbon .. .. dep.	4 18	—		arr.	4 10	71·7	
22·7	Tunnel City .. .. pass	4 38	75·3		pass	3 51	78·0	
35·7	Sparta .. .. ,,	4 46	78·0	70·4	,,	3 41	75·2	70·4
57·0	Medary .. .. ,,	5 04	71·0		,,	3 24	33·6	
59·8	arr.	5 09	33·6		dep.	3 19	—	
0·0	La Crosse .. .. dep.	5 14			arr.	3 14	53·4	
26·7	arr.	5 45	51·7	51·7	dep.	2 44	—	51·7
0·0	Winona .. .. dep.	5 45	—		arr.	2 44	61·9	
33·0	Wabasha .. .. pass	6 15	66·0	64·6	pass	2 12	63·0	62·4
62·4	arr.	6 43	63·0		dep.	1 44	—	
0·0	Red Wing .. .. dep.	6 43	—		arr.	1 44	58·3	
20·4	Hastings .. .. pass	7 00	72·0		pass	1 23	24·0	
21·2	*St. Croix Tower* .. ,,	7 02	24·0	53·1	,,	1 21	58·3	56·7
33·5	Newport .. .. ,,	7 15	48·4		,,	—	—	
41·6	ST. PAUL .. .. arr.	7 30	34·7		dep.	1 00	—	

* From start to stop.

Chicago-St. Louis services. Between Chicago and Detroit the Pennsylvania and the Wabash are jointly in competition with the Michigan Central, and this competition has produced the Detroit Arrow of the Pennsylvania, to which reference has been made previously, owing to the Wabash portion of the route, between Fort Wayne and Detroit, being unsuitable for equally high speeds. This train covers 294 miles in 5 hr. in each direction, and the competing Twilight Limited of the Michigan Central takes the same time for 283·5 miles, with six intermediate stops. The Union of the Pennsylvania competes between Chicago and Cincinnati with the Sycamore of the Big Four on a 6-hr. schedule, the former, as previously mentioned, doing its high speed over the favourable stretch between Chicago and Fort Wayne. Between Chicago and St. Louis the Illinois Central, Chicago & Eastern Illinois, Chicago & Alton, and Wabash are all in competition with 5½-hr. trains, the I.C. with the Daylight and the Michigan Boulevard, over 294·2 miles with seven intermediate by the other competing trains are above the 60 m.p.h. level between stops.

It is curious that while these rapid advances in speed have been made in the Middle West, the historic competition between the Reading and the Pennsylvania lines, which at one time produced the fastest booked railway run in the world—the Reading's 55·5 miles from Camden (Philadelphia) to Atlantic City in 50 min., with an average of 66·6 m.p.h.—has now lapsed by reason of the fusion of the two companies' interests between Philadelphia and the New Jersey coast into the Pennsylvania-Reading Seashore Lines. Certain parts of the original competing routes have been abandoned, and the new joint route between Camden and Atlantic City, which is 57·9 miles long, has no timing over its whole length shorter than 57 min. On the other hand, the New York-Philadelphia-Washington speed-up of the electrified Pennsylvania has elicited no mean response from the Baltimore & Ohio, whose most effective competition is given by the streamlined Royal Blue steam-hauled express, covering the 223·6 miles of the B. & O. route in 4 hr., with seven intermediate stops.

Table B sets out the aggregate number and mileage of the high speed runs performed by American railways. No fewer than eighteen timings at over 70 m.p.h. from start to stop figure in the current timetables, with a total mileage of 935; twelve of these, including the two fastest—which are at the same time the fastest steam-hauled runs in the world (the two runs which head the Pennsylvania list)—are with steam locomotives. Thirteen of these journeys (nine steam, two diesel, and two electric) are faster from start to stop than the fastest British run at the present time. The 41 American runs, totalling 2,651 miles, booked at 68 m.p.h. and over, no less than the 67 (3,964 miles) at 66 m.p.h. and over, and the 116 (6,703 miles) at 64 m.p.h. and over, all provide astonishing evidence of current railway speed progress in the United States. It will be seen that steam is still ahead of diesel and electrical propulsion, in all ranges of speed, though in the aggregate mileages booked at 60 m.p.h. and over electricity is now running steam fairly close.

As regards lengthy non-stop journeys in the U.S.A. pride of place is taken by the Pennsylvania, with the 188·7 miles between Pittsburgh and Crestline, covered without a stop by five trains daily, including the Broadway Limited in each direction. On the New York Central, between Buffalo and Collinwood, East Cleveland, or C. & P. Crossing, all in the Cleveland area and from 175·4 to 178 miles distant, there are eight non-stop runs daily. The Pennsylvania has three between Pittsburgh and Mansfield, 175·2 miles. On the Wabash the Banner Blue Limited covers the 165·9 miles between Englewood and Decatur non-stop in both directions.

In conclusion, it may be emphasised that many of the American runs tabulated are actually slightly faster than shown, as at all but the principal stations, arrival and departure times at stations are shown to coincide, American arrrangements in regard to luggage and parcels permitting of very brief station stops. Many of the times detailed, therefore, are from start to re-start, rather than from start to stop, and their merit is proportionately enhanced. "Flag," or conditional stops have not been taken into account except where there is reason to believe that they are regularly made. Acknowledgment is due to Mr. Eric Crickmay, of New York, and Mr. Donald Steffee, of Brooklyn, for help given in the preparation of the figures, and also to the New York Central, Pennsylvania, Baltimore & Ohio, Reading, Michigan Central, Big Four, Chicago, Milwaukee, St. Paul & Pacific, Chicago & North Western, and Chicago, North Shore & Milwaukee Railways for having kindly supplied copies of their working timetables, which have greatly facilitated the ascertainment of accurate mileages over the various routes, and the checking of the tables generally.

International Railway Congress Association Thirteenth Session, Paris, 1937

List of questions and reporters

First Section: Way and Works

QUESTION I.—Requirements of modern permanent way to carry heavy, high-speed traffic, and methods of modernising existing permanent way to meet these conditions. Turnouts for high-speed running.

Reporters

Belgium, Holland and overseas possessions; Luxembourg, Denmark, Norway, Sweden, Finland, Germany, Poland, Austria, Hungary, Switzerland: M. LEMAIRE, Belgian National Railways.

France, Portugal, and overseas possessions; Spain, Italy, Czechoslovakia, Bulgaria, Roumania, Jugoslavia, Greece, Turkey, Egypt: M. FLAMENT, Northern Railway of France.

Japan, Great Britain and British Empire; America, China: DR. KIKUMATSU HIRAI and DR. TAKAJI YAMADA, Japanese Government Railways.

QUESTION II.—Application of welding (1) for long rail lengths (2) for construction and maintenance of permanent way parts. (A) Results obtained with long rail lengths in service. Provision for expansion and anchorage. (B) Technical and economic results of welding for permanent way parts.

Reporters

Germany; Belgium, Holland and overseas possessions; Luxembourg, Denmark, Norway, Sweden, Finland, Poland, Austria, Hungary, Switzerland: HERR MÜLLER, German State Railway.

France, Portugal, and overseas possessions; Spain, Italy, Czechoslovakia, Bulgaria, Roumania, Jugoslavia, Greece, Turkey, Egypt: M. RIDET, Eastern Railways of France.

Great Britain and British Empire; America, China, Japan: MR. G. ELLSON, Southern Railway.

QUESTION III.—Systematic and periodical maintenance of (1) steel bridges; (2) signals; (3) steel supports of overhead electric supply systems.

Reporters

Portugal, France, and overseas possessions; Spain, Italy, Czechoslovakia, Jugoslavia, Bulgaria, Roumania, Greece, Turkey, Egypt: M. MENDOZA, Northern Railway of Spain.

Great Britain and British Empire; America, China, and Japan: MR. W. A. FRASER, London & North Eastern Railway.

Belgium, Holland, and Colonies; Germany, Luxembourg, Denmark, Norway, Sweden, Finland, Poland, Austria, Hungary, Switzerland: M. MUNDT, Netherlands Railways.

Second Section: Motive Power and Rolling Stock

QUESTION IV. — Constructional evolution of the railcar, with special reference to transmission and braking. Comparative tests of railcars. Detailed study of costs, and of possible means of reducing them.

Reporters

France, Belgium, Holland, Portugal, and overseas possessions; Great Britain and British Empire; Spain, Italy, Luxembourg: M. DUMAS, Northern Railway of France. M. LEVY, French State Railways.

Germany, Poland, Denmark, Norway, Sweden, Finland, Austria, Hungary, Switzerland, Czechoslovakia, Jugoslavia, Bulgaria, Roumania, Greece, Turkey, Egypt: HERR STROEBE, German State Railway.

America, China, and Japan: MR. WANAMAKER, Chicago, Rock Island, & Pacific Railway.

QUESTION V.—Recent improvements in normal types of steam locomotive, and trials of new types (high pressure and turbine), with reference to construction, qualities of materials used, efficiency, conditions of service and maintenance, and economic results. Tests of locomotives on testing plants and in service, by means of dynamometer cars and brake engines.

Reporters

France, Belgium, Holland, and overseas possessions; Luxembourg, Denmark, Norway, Sweden, Finland, Poland, Austria, Hungary, Switzerland: M. PARMANTIER, Paris, Lyons & Mediterranean Railway. M. DUGAS, P.O.-Midi Railways.

Great Britain and British Empire; America, China, and Japan: MR. H. N. GRESLEY, London & North Eastern Railway.

Portugal and overseas possessions; Italy, Spain, Czechoslovakia, Jugoslavia, Bulgaria, Roumania, Greece, Turkey, Egypt: M. MASCINI, Italian State Railways.

QUESTION VI. — Methods and arrangements for economy of current in electric traction, from the output at the generating station to the driving wheels (comprising transmission and contact lines, substations, and vehicles), with special reference to the use of mercury rectifiers.

Reporters

Switzerland; France, Portugal, Belgium, Holland, and overseas possessions; Spain, Italy, Luxembourg, Egypt: M. EGGENBERGER, Swiss Federal Railways.

Austria, Germany, Denmark, Norway, Sweden, Finland, Poland, Hungary, Czechoslovakia, Jugoslavia, Bulgaria, Roumania, Greece, Turkey; M. KAAN, Austrian Federal Railways. MR. C. E. FAIRBURN, London Midland & Scottish Railway.

Third Section: Operating

QUESTION VII.—Economical working of secondary lines of large systems. Various means for adapting motive power and rolling stock, safety measures, and station organisation to the requirements of traffic according to its importance.

Reporters

France, Belgium, and overseas possessions; Luxembourg, America, China, and Japan: M. GRANDJEAN, Alsace - Lorraine Railways. M. GILMAIRE, P.O.-Midi Railways.

Italy, Spain; Portugal and overseas possessions; Switzerland, Austria, Hungary, Czechoslovakia, Jugoslavia, Bulgaria, Roumania, Greece, Turkey, Egypt: M. PALMIERI, Italian State Railways.

Sweden, Norway, Denmark; Great Britain and British Empire; Holland and overseas possessions; Germany, Finland, Poland: M. EMERS, Swedish State Railways.

QUESTION VIII.—Planning of goods transport, with special reference (1) to the function and internal working of marshalling yards; (2) co-ordination of their services; (3) estimation of traffic to be moved and of trains required; (4) information for consignees; (5) accelerated circulation of empty stock; (6) use of containers and road-rail vehicles.

Reporters

Germany, Poland, Denmark, Norway, Sweden, Finland, Austria, Hungary, Czechoslovakia, Jugoslavia, Bulgaria, Roumania, Greece, Turkey, DR. BAUMANN, German State Railway.

Great Britain and British Empire; America, China, Japan: MR. V. M. BARRINGTON-WARD, London & North Eastern Railway.

Belgium, Holland, France, Portugal, and overseas possessions; Luxembourg, Spain, Italy, Egypt: M. COLLE, Belgian National Railways.

QUESTION IX.—Results obtained with automatic and long-distance operation of signals, points, and locomotive cab signalling devices.

Reporters

Great Britain and British Empire; France, Belgium, and overseas possessions; Luxembourg, America, China, Japan: M. TUJA, Paris, Lyons & Mediterranean Railway. M. LEMONNIER, French State Railways.

Poland, Germany; Holland and overseas possessions; Norway, Sweden, Denmark, Austria, Hungary, Czechoslovakia: M. MISZKE, Polish Ministry of Communications.

Italy, Switzerland, Jugoslavia, Bulgaria, Roumania, Greece, Turkey, Egypt, Spain; Portugal and overseas possessions: MM. BELLOMI and MINUCCIANI, Italian State Railways.

Fourth Section: General Questions

QUESTION X.—Effects of the world crisis and road competition on the railways. Consequent evolution of their commercial policy.

Reporters

All first class railways belonging to the union: DR. COTTIER, Swiss Federal Railways. HERR VON BECK, German State Railway.

All secondary railways: MM. LA

VALLE and MELLINI, General Supervision of Italian railways, tramways, and motor services.

First class railways not belonging to the union: MR. ASHTON DAVIES, London Midland & Scottish Railway.

QUESTION XI.—Selection, allocation to specific duties, and training of railway staff.

Reporters

Poland, Germany; Holland and overseas possessions; Denmark, Norway, Sweden, Finland: M. WOJCIECHOWSKI, Polish Ministry of Communications.

Czechoslovakia; France, Belgium, and overseas possessions; Luxembourg, Switzerland, Austria, Hungary, Jugoslavia, Bulgaria, Roumania, Greece, Turkey: M. HONDL, Czechoslovak Ministry of Railways.

Italy, Spain; Portugal and overseas possessions; Great Britain and British Empire; America, China, Japan, Egypt: M. LO BALBO, Piedmont Tramways Company.

Fifth Section: Light and Colonial Railways

QUESTION XII.—Co-ordination between large railway systems and light railways.

Reporters

France and overseas possessions; Great Britain and British Empire; America, Egypt, China, Japan: M. DELILLE, French Light Railways Co.

European Continent and overseas possessions, excepting France: MM. BELMONTE and TOSTI, Italian State Railways.

QUESTION XIII.—Specifications of way and works for railways of light traffic to minimise expenditure on construction, and generally to promote economy of operation.

Reporters

Continent of Europe and overseas possessions; Egypt: M. SVOBODA, Czechoslovak Ministry of Railways and Communications.

Great Britain and British Empire; America, China, and Japan: M. VAN NOORBEECK, Belgian National Local Railways Company.

Extensive Railway Preparations for the Olympic Games

Important engineering works on the Munich-Garmisch line carried out by the Reichsbahn

In anticipation of heavy traffic in connection with the Olympic Games, just held at Garmisch-Partenkirchen (especially in view of the extensive fare concessions announced in our issue of December 13 last), the German State Railway in March of last year sanctioned extensive engineering works in order to provide improved facilities on the Munich-Garmisch line, between Huglfing and Garmisch. These works, which were completed in time for the Olympic Games, are described in an article by Herr von Werden, Reichsbahnrat, in the journal of the Central European Railway Association, from which the following details are taken.

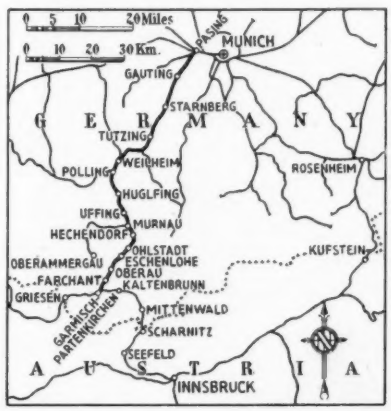
The line in question was built from Munich to Murnau between 1854 and 1879 by the State of Bavaria, and the remainder, as far as Garmisch, in 1889 by a private company, as a light railway with rather sharp curves and awkward gradients. This portion was taken over by the State in 1908 and certain improvements were then made. (The company in question still owns the branch line from Murnau to Oberammergau.) Electric traction was inaugurated on the Garmisch line in 1925 and from then it was classified as a main line.

Hitherto, a double track existed as far as Tutzing only, 40 km. (25 miles) from Munich. Between Murnau and Hechendorf there was a gradient of 2·6 per cent. and curves of 250 m. (273 yd.) radius, and heavy trains required bank engines to assist them into Murnau; the return movements of these engines on the single line formed a great obstacle to improving the train service, as did the long single line section between Huglfing and Uffing stations. In addition, increasing motor traffic on the Munich-Garmisch road, made it desirable to eliminate the five level crossings. The station at Garmisch, although well built and dating from 1912, when the old terminus was abandoned upon the completion of the through communication to Innsbruck, was not suited to the expeditious handling of heavy traffic.

The difficult section between Huglfing and Hechendorf was doubled, and opportunity was taken to make new alignments and flatter curves, so that the previous speed limit of 80 km.p.h. (50 m.p.h.) could be raised to 110 km.p.h. (68 m.p.h.) for the most part, and on the Murnau-Hechendorf portion from 55 km.p.h. (34 m.p.h.) to 80 (50). The ordinary traffic had to be kept running and an additional overhead conductor wire erected at the same time. Intensive use of rollers and tampers enabled an excellent road bed and track to be obtained in the minimum time, without risk of subsequent settlement. The doubling operations were begun in May last.

South of Murnau the line passes under the Oberammergau railway, and it was not possible to ease the gradient, but curves were improved to some extent and new road bridges built. Hechendorf station was considerably enlarged. To eliminate the level crossings the highway authorities re-routed certain parts of the Munich-Garmisch road, and the railway was deviated between Farchant and Garmisch. At Garmisch station the yard was rearranged, necessitating extensive modifications to the electric power signalling and overhead conductors without interfering with the heavy summer traffic. An additional platform was built and extra siding accommodation was obtained by moving the Zugspitz line station and the Griesen branch. Incidentally, the latter was closed (and replaced by a bus service) on the principal day of the Olympic games in order to serve as a long siding. The station buildings were altered and extended, and the resulting appearance is very pleasing. Some changes were also made at Kaltenbrünn and Mittenwald (the last German station) on the Innsbruck line, to enable those stations to assist in train marshalling and relieve Garmisch.

The works were planned and directed by the Divisional Offices at Munich and cost altogether 6,120,000 RM. (£515,000 at present rates). The short time available made it essential to concentrate large numbers of men on the task and some had to be obtained from other parts of the country, as southern Bavaria was unable to meet the demand. In all 55 private firms participated. Although undertaken to meet the exceptional sports traffic the alterations have resulted in a useful permanent improvement in railway facilities between Munich and Innsbruck, via Garmisch.



Sketch map of railway between Munich and Garmisch, which was considerably improved, and in part widened, in connection with the Olympic Games traffic

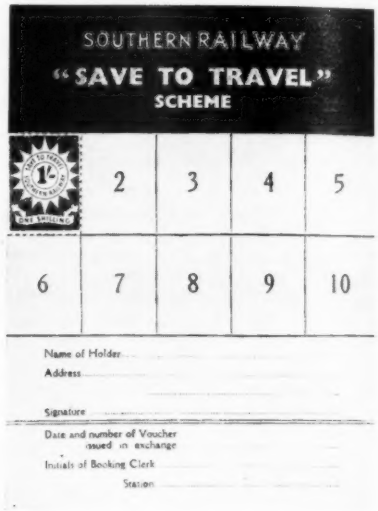
RAIL CONCESSIONS FOR VISITORS TO COLOGNE FAIR.—Visitors to the Cologne Fair from March 15 to 22 will be eligible for the 60 per cent. reduction on the German State Railway, even although they spend only one day in Germany. This reduction usually applies only to persons staying seven full days in Germany.

Railway Travel Saving Schemes

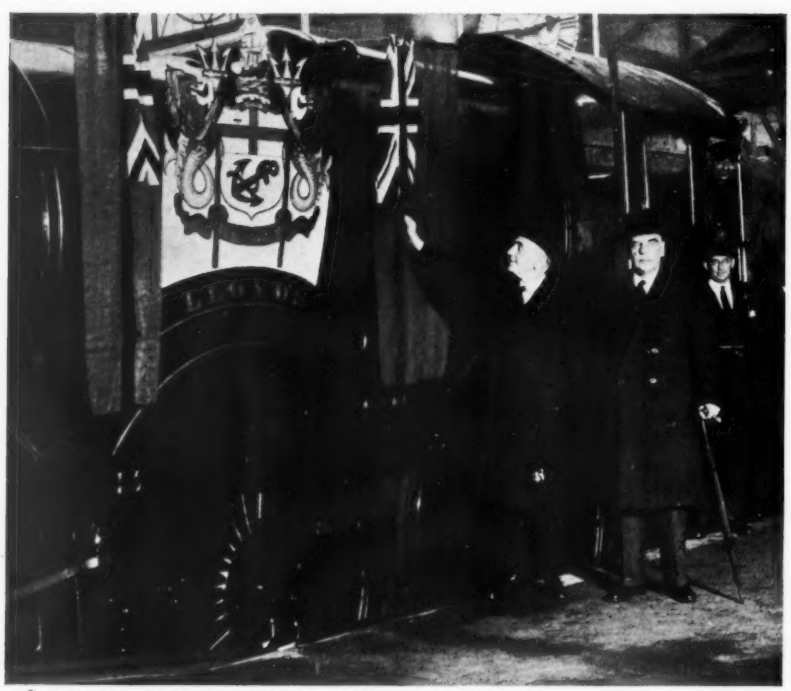
As recorded briefly in our issue of January 31, the Southern Railway introduced on February 1 a travel saving scheme similar to that recently announced by the L.M.S.R. and L.N.E.R.

Contribution cards providing spaces for ten special one-shilling "save to travel" stamps are available at all booking offices. When completed these cards may be exchanged for vouchers, which will bear interest at the rate of 5 per cent. a year for one year, *i.e.*, ½d. for each completed calendar month. Vouchers and stamped cards can be exchanged at any Southern Railway station or town office in payment or part payment for all descriptions of railway tickets, except seasons and tickets to Continental destinations. If the value of the vouchers and stamped cards exceeds the value of the tickets issued, change in cash will be given in respect of one partly-used voucher or card, subject to a minimum purchase of the value of 2s. 6d. If, owing to unforeseen circumstances, a purchaser is unable to travel and, therefore, does not exchange the stamps or vouchers for rail tickets, a refund of the actual value of the stamps or vouchers will be made, less a deduction of 2½ per cent. (minimum 6d.) to cover working expenses.

When describing the L.N.E.R. and L.M.S.R. schemes in our issue of January 24, we were unable to show a specimen L.N.E.R. ten-shilling voucher. We are now, however, reproducing this alongside an example of a Southern Railway savings card and stamp.



Left, a ten-shilling interest-bearing voucher as issued by the L.N.E.R. in exchange for ten "save to travel" stamps, and (right) a Southern Railway savings card and specimen stamp



Sir Robert Horne, Chairman of the G.W.R., with Mr. Neville Dixey, Chairman of Lloyd's, when Sir Robert unveiled the nameplate on the "Castle"-class locomotive which has been named "Lloyd's" and numbered A1

G.W.R. "A1 at Lloyd's"

In a brief ceremony on No. 3 platform at Paddington station, G.W.R., on Monday afternoon, Sir Robert Horne, Chairman of the G.W.R., officially unveiled the nameplate on one of the "Castle" class locomotives, which was recently named *Lloyd's* and numbered A1. This engine was formerly No. 4009, *Shooting Star*, and the renaming has been made as a compliment to Lloyd's underwriters. The ceremony took place in the presence of Mr. Neville Dixey, Chairman of Lloyd's, and the Committee of Lloyd's. For the occasion the nameplate was surmounted by Lloyd's coat of arms, with the motto "Fidentia," and Lloyd's house flag was flown. A string of flags of the international code spelling the familiar phrase "A1 at Lloyd's" was hung between the chimney and cab of the engine.

Among those present were:—

Alderman G. Fred Evans, Lord Mayor of Cardiff; Sir James Milne, General Manager, G.W.R.; Sir Ralph Cope, Chief Accountant; Mr. H. L. Wilkinson, Superintendent of the Line; Mr. F. R. E. Davis, Secretary; Mr. C. B. Collett, Chief Mechanical Engineer; Mr. C. R. Dashwood, Assistant General Manager; Mr. C. T. Cox, London Divisional Superintendent; and J. R. C. Williams, Stationmaster, Paddington.

At the ceremony the Committee of Lloyd's contributed 100 guineas to the G.W.R. directors' fund for distressed cases.

The Signal Engineers' Presidential Address*

The increasing use of scientific mechanisms has relieved the signalman of the need of using his natural gifts to the extent hitherto necessary; rather is he encouraged to rely upon mechanism. It is true we are living in a more enlightened period than when the "bobby" was responsible for the movement of traffic, but one questions whether, in spite of the care the railway authorities exercise over the training and education of signalmen, drivers, and those who should safeguard traffic movements, they are really obtaining equal, or better, personal service. Is it not possible that the signal engineer is unwittingly doing too much, and that signalling mechanisms are eventually considered as a means of relieving the individual of personal responsibility?

One of the most important and difficult problems confronting the signal engineer is that of harmonising the growing application of irrevocable mechanisms with the flexibility of operation and the freedom and intelligence of action of the human element. In many instances the two conditions are totally at variance, with the result that either flexibility must give way to irrevocable action, or irrevocable action give way to flexibility.

A typical illustration is in territory containing automatic signalling: a driver held at an automatically operated signal by a prolonged red indication is instructed to pass the location under precautionary rules. This has often caused trouble, and has materially reduced the value of the red indication generally. The conflicting conditions are that, on the one hand flexibility is necessary if the signal is out of order and the line ahead is clear, whilst, on the other hand, the definite meaning of the red indication needs to be interpreted if a train, possibly broken down, is in the section ahead. Up to the present there has been no economical and satisfactory solution which would definitely permit the carrying out of the absolute block working regulations under all conditions.

Many devices to meet these conflicting requirements have been suggested and are engaging the attention of signal engineers. Telephonic communication, sometimes with complete track circuit indications or an illuminated diagram, is provided in certain instances, but it is doubtful if this facility, even if rigidly framed speech is enforced, altogether eliminates the disadvantages referred to. When an accident does occur on our railways, it is not long before everyone is made aware of the circumstances, and all and sundry suggest devices which are intended to prevent a repetition. It is unfortunate there is not the same publicity in connection with the many incidents which occur where accidents have been avoided through the intelligent action of signalmen, drivers, or other personnel. In such event there would be less talk of remedial devices, and the railways would effect considerable economies in consequence.

The signal engineer of today is expected to be the Alpha and Omega in ensuring the absolute safety of traffic movement, and he needs the co-operation of the officers of other departments in determining the most satisfactory means of achieving this aim. Economies arising from signalling schemes generally accrue to departments other than the signalling department, which in consequence must bear increased charges. Hence the signalling is sometimes regarded—and quite incorrectly—as an expensive provision.

In my early training it was the rule to make all signalling arrangements as simple as possible, assuming that a certain amount of intelligence and responsibility for safe working would be forthcoming from members of other departments. Today, the policy appears to be to make everything connected with signalling as complicated as possible, overlooking the fact that intelligence is going to be shown by the staffs of other departments.

Fashions change very rapidly, and the old saying "As good out of the world as out of fashion" is as applicable to signalling as anything else. Fashions, however, in many instances, come and go in cycles, and many old fashions become current features with modern trimmings. As with fashions, so it may be with signalling, and what was looked upon as old-fashioned or out-of-date may in the future be re-adopted and modernised.

It is not suggested that the cycle of events will bring us back to the "bobby" era, or even to wholly manual operation methods of signalling; on the other hand, I submit it is unlikely that the pursuit of economy will be wholly on the lines of automatic or power-operated methods, and we shall be more inclined to "cut our coat according to our cloth." I picture future installations as containing both manual and power operating means, with a great use of remote point working methods.

If our proceedings over a period of years are reviewed, it will be apparent that manually operated signalling methods have received scant consideration. This is to be regretted, and it is hoped that in the future these will received the consideration they certainly deserve. The traditional safeguards and economy resulting from manually operated methods need no emphasis. Those engineers who were responsible for these methods are just as concerned as others with the basic principles of signalling, and it is incorrect to assume that the principles of manually operated signalling should now be restricted. Such principles form practically 98 per cent. of the signalling installations in this country at the present time, and are still giving a good account of themselves. One of the main difficulties experienced by those in command of our signalling efforts is to find suitable engineers who can think of signalling in conjoint terms of the manual and power operated systems, plus the protection available by the discreet application of track circuiting.

The position in which we find ourselves today is that the development of the manually operated methods have been more or less at a standstill for years. The various mechanisms continue to be fashioned after the methods originally devised. The Board of Trade requirements, dated 1892, included the following:—

> The limit of distance from levers working points to be 200 yards in the case of facing points, and 300 yards in the case of trailing points on the main line or safety points of sidings.

The Ministry of Transport present equivalent requirements are:—

> The limit of distance from levers working points to be 350 yards unless the points are power worked and occupation of the line is electrically indicated in the signal box, in which case the distance may be indefinitely extended.

By using rod transmission for the operation of points 350 yd. distant from the operating lever, approximately one-and-a-half tons of rodding and other fitments have to be moved the requisite distance for operation. In addition, the friction caused by rollers, cranks, compensators, sets, curves, &c., has to be overcome. If the points are situated on a gradient, the proportion of the rodding, &c., on the gradient has also to be lifted the required distance, when the lever is either being pulled or replaced. All this work has to be accomplished by the operator before the actual duty required of the lever frame has been performed.

To increase the distance permitted to manual operation, a method of transmission which will reduce the effort required by the signalman with rod transmission is essential. This question is one which is worthy of serious consideration, and the most economical method which comes to my mind is by the use of oil transmission.

The question of economy has to be viewed from many aspects. There are still many locations where amalgamation schemes can be effected which will show greater economies, provided they are not killed in the early stages by too many "frills and fancies." And, whilst still on the subject of economy, one might suggest the need for bearing in mind the scope offered by the single tracking of certain branch lines without in any way impairing the running of traffic over such lines.

* Abstract of the presidential address, delivered by Mr. W. S. Roberts, to the Institution of Railway Signal Engineers, on Wednesday, February 12.

The Brussels Nord-Midi Junction Railway

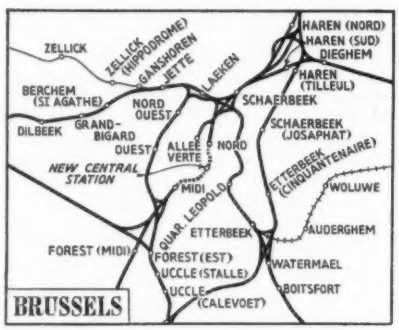
In an editorial note on page 323 we outline the pre-war progress in the century-old proposals to link the stations on the north and south of Brussels. The Nord and Midi terminal passenger stations are about two miles apart, and the only rail connection between them at present, by means of a junction line to the west of the city, involves the reversal of trains. From time to time we have recorded the recent discussions as to completing a direct line, and we are now able to publish brief details of the plans recently adopted by the Belgian Government.

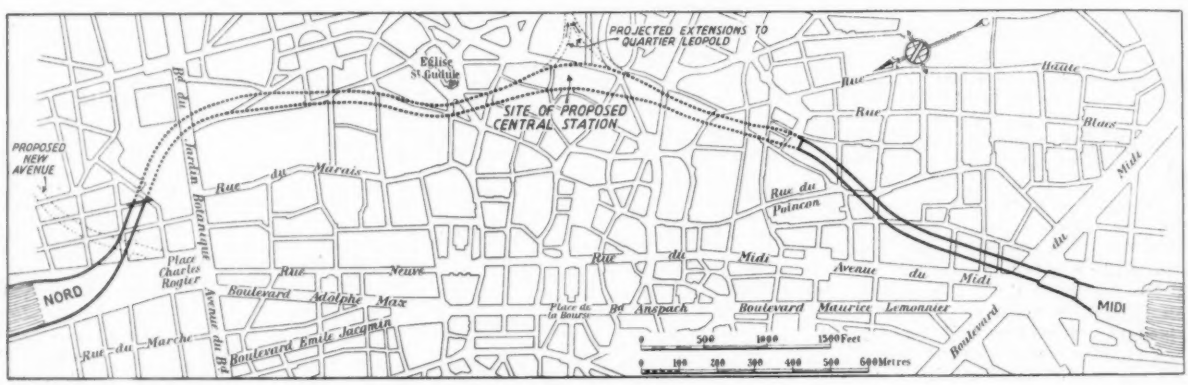
As will be seen from the sketch map below, the intention is to build a connecting line through the heart of the city, with a central station on a site near the Collegiate Church of St. Gudule. In 1930 tenders were invited for driving the tunnel, which will be one of the works, and the contract has now been awarded to the Société Belge des Bétons. The total cost of the line and of the necessary alterations at the Nord and Midi stations has been estimated, before devaluation of the currency, at fr. 500 million.

No final decision has been made as to the exact use to which the line will be put, and it is suggested that the through facility may be restricted to a few important services. It seems more probable that the alternative will be adopted, namely, that the intermediate "central" station, in the commercial centre of the city, will be served by frequent electric services to and from the principal towns within a radius of 30 miles of the capital. Studies by the Administrative Council of the Belgian National Railways suggest that the working of the Nord-Midi connecting line should result in an annual deficit of about fr. 2·2 million, given receipts calculated at fr. 7 million at the normal rates. It may be expected that a progressive increase in the number of passengers will reduce this deficit, leading to its disappearance after a few years of working.

Although the junction line is to be worked by the Belgian National Railways, a separate body was created by Act of July 11, 1935, called the Office National pour l'Achèvement de la Jonction to undertake the completion of the line. It is attached to the Ministry of Transport, with civil service status, and is controlled by a board. This body is vested with the necessary powers regarding the acquisition of land and building of the line, and the handling (by sale or lease) of surplus lands. The board is composed of the Minister of Transport, who is automatically its President, of a Vice-President, and of fifteen other members, among whom must be at least two delegates of the Finance Minister, one of the Minister of Transport, one of the Minister of Public Works, one of the City of Brussels, and one of the Belgian National Railways Company. Each delegate has a deputy. The Vice-President, as well as the members and their deputies, are nominated by Royal Decree. The board itself elects its chairman, and decides upon his remuneration subject to royal approval.

The connecting line is estimated to be completed in three years, but five years are expected to elapse before the rebuilding and approach alterations to the Nord and Midi stations are finished. The Office National pour l'Achèvement de la Jonction will bear the cost of building the new line, of the Nord and Midi alterations, and of equipment for electric traction. The Belgian National Railways, however, are to pay for the Nord and Midi station works necessary irrespective of the new line. With regard to the working of the line by the Belgian National Railways Company, that company will retain the ordinary fares and also collect for the O.N.A.J. a surtax to be agreed between the two parties, but sufficiently moderate not to injure traffic.





Sketch map (with key plan above) of the course adopted for the proposed Nord-Midi junction line in Brussels

Exports of Railway Material from the United Kingdom in January

	Jan. 1936	Jan 1935
	£	£
Locomotives, rail	98,588	60,948
Carriages and wagons	147,038	87,181
Rails, steel	38,881	69,601
Wheels, sleepers, fishplates and miscellaneous materials	36,662	79,444

Locomotive and rail exports included in the following:—

	Locomotives		Rails	
	Jan. 1936	Jan. 1935	Jan. 1936	Jan. 1935
	£	£	£	£
Argentina	—	—	7,477	8,018
Union of South Africa	—	—	11,864	64,927
British India	2,320	3,215	12,606	24,999

RAILWAY AND OTHER MEETINGS

Mersey Railway Company

The annual general meeting of the Mersey Railway Company was held at Winchester House, Old Broad Street, E.C., on February 20, Mr. John Waddell, J.P., Chairman of the company, presiding

The Secretary, Mr. Joshua Shaw, read the notice convening the meeting and the auditor's report.

The Chairman, in moving the adoption of the report and accounts, said that after making due provision for the renewal funds amounting to £6,000, the net revenue for the year was £85,955, as compared with £86,635 for 1934. To this was added the amount brought forward from last year's account, £3,342, making a total of £89,297. The balance available for payment of dividend on the ordinary stock was £12,682, a decrease of £1,251. Of this sum the directors had recommended that £10,592 be applied in payment of a dividend on the ordinary stock of ¾ per cent., and that the balance of £2,090 be carried forward to next year's account, as compared with £3,342 for 1934.

The gross receipts from railway working for the year were £211,512, a decrease of £2,261. Expenses decreased by £2,277 to £125,856, leaving net receipts £16 higher at £85,656. For the year 1935 train mileage increased by 83 to 541,815, and passenger journeys increased by 94,901 to 17,577,632.

During the summer the company again provided many special cheap facilities between Liverpool and the various holiday resorts in Wirral, and traffic from this source showed an improvement. From May 1 first class cheap day fares had been further reduced, so that the number of passengers using them was more than doubled, and the loading of trains improved by better distribution between first and third class coaches. It was difficult to prophesy with accuracy as to the prospects for 1936, but from present indications it would appear that trade conditions would continue to improve and employment increase, which should have the effect of increasing the traffic on all passenger carrying undertakings. The position of the shipbuilding and shipping industries generally on Merseyside was improving, and such improvement could not fail to have a beneficial effect on the company's revenue.

The company did not consider it was getting a fair share of the increased traffic accruing from developments on the outskirts of Birkenhead, because the Birkenhead Corporation gave preferential treatment to users of the combined bus and ferry route as compared to passengers by bus and railway. The matter had been brought before the Traffic Commissioners of the North Western Area. The opening of the Mersey road tunnel had affected the company adversely by the diversion to the tunnel of mail traffic, which was allowed to use it without payment of toll. Two stage coach services from North Wales which had applied for an extension from Birkenhead to Liverpool via the tunnel in 1934 had not secured permission to do so, but had appealed to the Ministry of Transport against this decision.

With regard to the publicity which had been given to the question of the co-ordination of the transport services of Merseyside, the advocates of the suggestion had been largely influenced by the example of the London Passenger Transport Board. It must, however, be borne in mind that the undertakings embraced in that scheme were, the Chairman understood, profit earning, whereas in the case of Merseyside there were rate aided undertakings working at a very heavy loss. He did not know whether it was suggested that these losses should become a permanent charge on the rates, otherwise it was very difficult to see how co-ordination could be brought about.

The company had already increased the carrying capacity of its trains, and had now decided to introduce through services to the Wirral following electrification of the L.M.S. lines in that area. Mersey Railway trains would work a ten-minute service between Liverpool and New Brighton at the hours of business traffic, and a fifteen-minute service at other parts of the day. Various improvements would be carried out in connection with these developments, among them being the installation of four high-speed electric lifts at James Street station to replace the two hydraulic lifts now in use, and the electric heating of trains. The board had agreed to stabilise the payments for bonus mileages now accruing to the Mersey Railway on traffic with the Wirral section of the L.M.S.R., which company would bear the cost of works on the Mersey Railway necessary for running through services.

The Chairman concluded by recalling the jubilee of the Mersey Railway on January 20 last, and in tracing its history from that date paid special tribute to the work of Mr. Shaw, its General Manager, Secretary, and Engineer since 1908.

S.R. Locomotive Running Department Dinner

The eleventh annual dinner of the Southern Railway Locomotive Running Department was held on Wednesday evening at the Strand Palace Hotel, London, under the chairmanship of Mr. D. Sheppy, Eastern Divisional Locomotive Running Superintendent. Among those present were:—

Messrs. W. H. Austen (Kent & East Sussex), A. Cobb, W. Challis, O. Cromwell, J. Clayton, T. Chrimes, G. H. Hare Dean, C. V. Hill, E. F. E. Livesey, W. Marsh, A. B. MacLeod, W. G. Pape, H. E. Robarts, J. Rogers, G. H. Snow, C. M. Steadman (L.N.E.R.), C. L. Simpson (G.W.R.), E. M. Turnbull, A. White, and W. A. Willox.

Mr. A. Cobb, responding to the toast of "The Southern Railway Directors and Officers" which had been proposed by Mr. H. Lelew, referred to the regretted absence of Mr. A. D. Jones, Locomotive Running Superintendent, and explained that his absence was due to illness which also necessitated his premature resignation from office. Mr. Cobb paid a tribute to Mr. Jones, under whom he had worked since the latter joined the South Eastern & Chatham Railway in 1912 to form the Outdoor Locomotive Carriage & Wagon Department. The 24 subsequent years had included the eventful times of the war, when the old South Eastern had had to cope with unprecedented traffic under the most difficult conditions, and the formation of the Southern Railway when Mr. Jones had been appointed to preside over the Locomotive Running Department and had been responsible for its organisation and successful conduct ever since. Mr. Cobb also referred to the enterprise of the Southern Railway directors and officers since the formation of the company, an enterprise of which there was tangible evidence in the large number of reconstructed stations, modernised locomotive depots, new signalling installations, and, of course, extensive electrification.

Mr. A. White proposed the toast of "The Locomotive Running Department" and thanked its members for their wholehearted co-operation with the Traffic Department, not only in providing motive power for the trains, but sometimes in providing opportune excuses for awkward situations. His speech was punctuated by entertaining anecdotes, including a tale, the accuracy of which was later disputed, of his experience on board a cargo boat going up the Channel between Folkestone and Dover when they had overtaken the boat train on the coast railway. On drawing attention to it the skipper remarked: "Yes, we often pass it about here."

Mr. D. Sheppey, in responding to the toast, read a telegram of sympathy he had sent on behalf of the gathering to Mr. Jones. Mr. Sheppey took the opportunity of congratulating and thanking the staff of the Locomotive Running Department for their loyal and able work during the past year of heavy traffic and exceptional circumstances, including the working of many Royal trains in connection with the late King's funeral. A very pleasant evening was terminated by a vote of thanks to Mr. Hall, who had so successfully organised the dinner.

NOTES AND NEWS

More Railway Camping Coaches.—The camping coach holiday introduced by the British railways three years ago has proved so popular that 108 additional camping coaches are being fitted up. This represents an increase of 50 per cent. in the number in service last year and brings the total number of camping coaches which will be available for the coming months to 323.

French Railcar Driven by Charcoal Gas.—On February 17 a railcar driven by charcoal gas, now being tested for railway service, was demonstrated on the French State Railways on the Paris (Montparnasse)-Chartres line. The Ministers of War, Public Works, and Agriculture were present at the demonstration as well as the constructor of the engine, M. Paul Panhard.

Canadian Pacific Earnings.—Gross earnings of the Canadian Pacific Railway for the month of December, 1935, amounted to $11,581,000, an increase of $875,000 in comparison with December, 1934. In the working expenses of $8,275,000 there was an increase of $740,000, leaving net earnings $135,000 higher, at $3,306,000. For the twelve months to December 31, 1935, gross earnings were $129,679,000, an increase of $4,136,000, and net earnings $22,398,000, a decrease of $1,986,000.

Road Accidents.—The Ministry of Transport return for the week ended February 15 of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding period of last year:—

	Killed, including deaths resulting from previous accidents		Injured	
England ...	84	(111)	2,453	(2,892)
Wales	3	(5)	92	(123)
Scotland ...	7	(11)	239	(305)
	94	(127)	2,784	(3,320)

The total fatalities for the previous week were 102, as compared with 130 for the corresponding period of last year.

Train Control in the North of England, L.N.E.R.—A train control office is to be provided in York for the supervision of traffic working in the York district, L.N.E.R.; the new office will also absorb the existing Leeds Control. At the present time, the running of all trains working over the main line between Shaftholme Junction (Doncaster) and Newcastle, a distance of 108 miles, is controlled from the main line train control office at York. Other controls designed primarily for the control of freight trains are in existence at Newcastle, Darlington, Middlesbrough, Leeds, and Hull. The Newcastle Control supervises also the working of passenger trains between Newcastle and Berwick, and each of the several traffic controls takes over the supervision of passenger trains in the event of an emergency. The provision of a Control Office at York means that the working of trains over the branches in the York district will be controlled in a similar manner to trains in other districts in the North of England.

North Central Wagon Finance.—The capital of the North Central Wagon Co. Ltd. has been increased by £500,000 in £1 ordinary shares to £1,800,000. This increase is required in connection with the acquisition of all the shares of the Lincoln Wagon & Engine Co. Ltd., which will retain its separate existence under the control of the North Central Company.

Shropshire & Montgomeryshire Railway.—On Monday, February 10, a goods train on the Shropshire and Montgomeryshire Light Railway, travelling between Kinnerley Junction and Criggion quarries, ran into five horses belonging to Mr. Harry Davies, of Melverley Hall, Shropshire, by the Chapel Lane crossing. Two were killed outright and a third had to be destroyed.

Freight and Exchange Agreement.—A Reuters message dated Buenos Aires, February 15, states that an agreement has been reached between the Government and the British-owned railway companies, whereby the present railway tariffs are to be maintained during 1936 except in the case of maize. For the transport of maize, reductions involving a total of 3,500,000 pesos are to be made in conformity with an approved scale, according to which the larger reductions will be made for the longest hauls. In consideration of this concession, the exchange rate at which the railways can transfer their funds has been fixed at 15·75 pesos to the £ for the year.

Progress of Railway Bills.—The following Bills were read a first time in the House of Commons on February 6: Great Western Railway (Additional Powers); Great Western Railway (Ealing & Shepherd's Bush Railway Extension); London & North Eastern Railway (General Powers); London & North Eastern Railway (London Transport); London Midland & Scottish Railway; London Passenger Transport Board; Southern Railway. On February 11, the G.W.R. (Ealing & Shepherd's Bush Railway Extension), the L.N.E.R. (London Transport), and the Southern Railway Bills were read a second time in the House of Commons, and referred to the Examiners, and the same procedure was followed with the G.W.R. (Additional Powers) Bill on February 13. After a short debate, the second reading of the L.M.S.R. Bill was agreed to in the House of Commons on February 19. In reply to complaints as to the condition of Stonebridge Park station, Sir Ralph Glyn said that in the ordinary course the improvement of this station was to be undertaken forthwith, and work of improvements of the character suggested would be completed in a very few weeks.

Imp Petrol-Driven Tractors.—The Imp petrol-driven tractor, to which we made reference on page 306 of last week's issue, is designed and marketed by Lansing Bagnall & Company, of 98, Victoria Street, London, S.W.1. It is available for haulage both on station platforms and as a works tractor. The L.M.S.R. has a number in use in various parts of the system, including some at St. Pancras, Euston, and New Street (Birmingham) stations, and at Derby, Crewe, Earlestown, and other works.

Railway Demonstrations, L.N.E.R.—Exhibitions of rolling stock are being given by the L.N.E.R. at Manors North station, Newcastle, and at Nottingham. The former began on February 17, and is continuing for three weeks. At Nottingham the exhibition will be from February 24 to 29. These exhibitions are mainly for the benefit of schoolchildren. The vehicles on exhibition include a modern locomotive in steam, locomotive and signalling demonstration vans, a mail van, buffet car, sleeping car, camping coach, and the latest types of tourist train stock.

Manila Railway Co. (1906) Ltd.—The Manila Railroad Company has accepted the offer of the Manila Railway Co. (1906) Ltd., which is an English holding company, to sell to the Manila Railroad at the price of 80 per cent. the whole of the $8,170,000 Southern Lines first mortgage bonds of the Manila Railroad. These bonds are held by the English company to secure its 5 per cent. debenture stock and its A and B debentures. The net proceeds of the sale are to be utilised in redeeming the company's 5 per cent. debenture stock at 85 per cent., any surplus to be used for redeeming the A debentures by purchase or tender. The sale was approved on October 24 last by meetings of stockholders and of the holders of the A and B debentures.

The Indian Railway Budget.—The Indian Railway Budget as presented in the Legislature by the Minister for Railways on February 17, shows a probable deficit for the year ending March 31, 1936, of £2,000,000 more than originally anticipated. Receipts are now expected to be £150,000 less than in 1934-35, working expenses remaining about the same. Total receipts are expected to be about £67,500,000 and working expenses — including £10,000,000 for depreciation — about £48,000,000. Interest charges have, however, fallen by about £330,000. The net result is therefore likely to be a deficit of £3,250,000, £1,750,000 on commercial and £1,500,000 on strategic lines. This deficit will again have to be met by a loan from the Depreciation Fund, in 1936-37. The Budget anticipates a deficit of about £2,500,000 in 1936-37. At the end of that year the Depreciation Fund balance will stand at only £8,750,000, £26,500,000 having by then been withdrawn from that fund to meet successive deficits.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 7th Week			Totals to Date		
	1936	1935	Inc. or Dec.	1936	1935	Inc. or Dec.
L.M.S.R. (6,919½ mls.)	£	£	£	£	£	£
Passenger-train traffic...	361,000	362,000	– 1,000	2,524,000	2,515,000	+ 9,000
Merchandise, &c. ...	462,000	457,000	+ 5,000	3,090,000	3,032,000	+ 58,000
Coal and coke ...	277,000	273,000	+ 4,000	2,008,000	1,884,000	+ 124,000
Goods-train traffic ...	739,000	730,000	+ 9,000	5,098,000	4,916,000	+ 182,000
Total receipts	1,100,000	1,092,000	+ 8,000	7,622,000	7,431,000	+ 191,000
L.N.E.R. (6,336 mls.)						
Passenger-train traffic...	240,000	246,000	– 6,000	1,705,000	1,701,000	+ 4,000
Merchandise, &c. ...	318,000	310,000	+ 8,000	2,166,000	2,122,000	+ 44,000
Coal and coke ...	260,000	256,000	+ 4,000	1,844,000	1,724,000	+ 120,000
Goods-train traffic ...	578,000	566,000	+ 12,000	4,010,000	3,846,000	+ 164,000
Total receipts	818,000	812,000	+ 6,000	5,715,000	5,547,000	+ 168,000
G.W.R. (3,746½ mls.)						
Passenger-train traffic...	144,000	145,000	– 1,000	1,078,000	1,074,000	+ 4,000
Merchandise, &c. ...	179,000	178,000	+ 1,000	1,231,000	1,223,000	+ 8,000
Coal and coke ...	107,000	110,000	– 3,000	817,000	768,000	+ 49,000
Goods-train traffic ...	286,000	288,000	– 2,000	2,048,000	1,991,000	+ 57,000
Total receipts	430,000	433,000	– 3,000	3,126,000	3,065,000	+ 61,000
S.R. (2,154 mls.)						
Passenger-train traffic...	227,000	228,000	– 1,000	1,661,000	1,631,000	+ 30,000
Merchandise, &c. ...	56,500	58,000	– 1,500	380,000	395,500	– 15,500
Coal and coke ...	37,500	38,000	– 500	267,000	247,500	+ 19,500
Goods-train traffic ...	94,000	96,000	– 2,000	647,000	643,000	+ 4,000
Total receipts	321,000	324,000	– 3,000	2,308,000	2,274,000	+ 34,000
Liverpool Overhead ... (6½ mls.)	1,052	1,104	– 52	8,118	7,692	+ 426
Mersey (4½ mls.) ...	3,938	3,903	+ 35	29,800	29,206	+ 594
*London Passenger Transport Board ...	515,800	513,600	+ 2,200	17,916,300	17,600,900	+ 315,400
IRELAND						
Belfast & C.D. pass. (80 mls.)	1,685	1,697	– 12	11,950	12,223	– 273
,, ,, goods	528	465	+ 63	3,165	3,073	+ 92
,, ,, total	2,213	2,162	+ 51	15,115	15,296	– 181
†Great Northern pass. (543 mls.)	7,500	6,850	+ 650	45,800	43,000	+ 2,800
,, ,, goods	9,350	8,100	+ 1,250	55,600	53,750	+ 1,850
,, ,, total	16,850	14,950	+ 1,900	101,400	96,750	+ 4,650
†Great Southern pass. (2,076 mls.)	25,437	24,816	+ 621	158,759	152,705	+ 6,054
,, ,, goods	36,824	35,061	+ 1,763	248,026	256,645	– 8,619
,, ,, total	62,261	59,877	+ 2,384	406,785	409,350	– 2,565

* 33rd week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period last year; last year's figures are, however, adjusted for comparative purposes
† 6th week

British and Irish Railways Stocks and Shares

Stocks	Highest 1935	Lowest 1935	Prices Feb. 19, 1936	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	55½	44½	48½*	–5
5% Con. Prefce. ...	124	108	120½*	–1
5% Red.Pref.(1950)	117	106¾	108½*	–2
4% Deb.	118½	108	115½	—
4½% Deb. ...	122	110	117½	—
4½% Deb. ...	129½	118	127½	—
5% Deb.	140¼	130	140½	+2
2½% Deb.... ...	82¼	68½	77	+1
5% Rt. Charge ...	137	128	134½	—
5% Cons. Guar. ...	136¾	120½	132½*	–2
L.M.S.R.				
Ord.	25 5/16	16	20½	–2
4% Prefce. (1923)	58¼	43½	65*	–6½
4% Prefce. ...	87½	73½	84½*	–3
5% Red.Pref.(1955)	107	97¾	105½	—
4% Deb.	110¼	99½	107	—
5% Red.Deb.(1952)	119 11/16	111 5/16	118½	+1
4% Guar.... ...	105⅝	95½	103	—
L.N.E.R.				
5% Pref. Ord. ...	15⅞	8¼	10¼	–¾
Def. Ord.	7 9/16	4¾	5½	–⅜
4% First Prefce....	7⅝	4⅜	6⅛	–½
4% Second Prefce.	3⅛	1⅝	2⅜	–½
5% Red.Pref.(1955)	92¼	71	91½	+3
4% First Guar. ...	103 11/16	93	101½	—
4% Second Guar.	98¾	82½	94	—
3% Deb.	86	75	81	—
4% Deb.	109¼	98½	106	—
5% Red.Deb.(1947)	118½	106½	115½	—
4½% Sinking Fund Red. Deb.	112½	108	110	—
SOUTHERN				
Pref. Ord.... ...	87½	69⅝	90*	–4
Def. Ord. ...	25 15/16	16¾	21½	–1½
5% Prefce. ...	124	108¼	120½*	–2
5% Red.Pref.(1964)	117¾	109½	116½*	—
5% Guar. Prefce.	136½	121½	132½*	–2
5% Red.Guar.Pref. (1957)	121¼	112½	116½*	–1
4% Deb.	116¾	107	115	—
5% Deb.	138	130¼	136½	—
4% Red. Deb. 1962–67	115	106½	115½	—
BELFAST & C.D.				
Ord.	9	4	9	—
FORTH BRIDGE				
4% Deb.	111¼	104½	104½	—
4% Guar.... ...	109⅞	104	104½	—
G. NORTHERN (IRELAND)				
Ord.	20	7	16¾	–¾
G. SOUTHERN (IRELAND)				
Ord.	57½	14½	45	+2
Prefce.	50	25¼	49¾	—
Guar.	88¾	51¼	92¼	—
Deb.	86¼	70	89½	–½
L.P.T.B.				
4½% "A" ...	130	119¾	127	—
5% "A" ...	139¾	130	136½	—
4½% "T.F.A." ...	113¾	108	110	—
5% "B"	131½	122¾	130½	—
"C"	109½	91	102½*	–2
MERSEY				
Ord.	23⅛	9¼	25½	—
4% Perp. Deb. ...	100½	93½	97½	—
3% Perp. Deb. ...	75½	67	76	—
3% Perp. Prefce.	62	47¼	64½	—

* ex dividend

QUESTIONS IN PARLIAMENT

Proposed Fuka-Matruh Railway

Mr. Thurtle asked the Secretary of State for Foreign Affairs, recently, whether the railway which was being constructed from Fuka to Matruh was expected to be a remunerative undertaking; and, if so, why the British Government was not to receive any return on the sum of £20,000 which it is contributing to the project.

Mr. Eden.—From the information in my possession the answer to the first part of the question is in the negative. The second part of the question does not therefore arise.

Viscount Cranborne (Parliamentary Under Secretary, Foreign Office), replying on an earlier day to Mr. Gallacher, whose question also related to the dredging of Alexandria harbour, stated. —The estimated cost of the Fuka-Matruh Railway is £E94,000 and His Majesty's Government has offered towards that expenditure a sum not exceeding £20,000 sterling. The Egyptian Government is contributing the remainder.

Enfield Branch Facilities

Mr. Bull asked the Minister of Transport whether he would represent to the L.N.E.R. the need for improvements in travelling facilities on the Enfield branch line as soon as they had completed the works they had promised to undertake under their agreement with the Government.

Mr. Hore-Belisha.—Yes, sir. The railway company has given an assurance that, as soon as the present works have been completed, the situation in other districts will receive consideration.

CONTRACTS AND TENDERS

The Birmingham Railway Carriage & Wagon Co. Ltd. has received an order from the San Paulo Railway for 10 second-class coaches.

Motorship for L.M.S.R.

Vickers-Armstrongs Limited has received an order from the L.M.S.R. for a twin-screw passenger motorship for service on Lake Windermere. The vessel will have dimensions of 135 ft. × 25 ft. × 4 ft. 9 in. and will accommodate about 800 passengers. Gleniffer DC8 type diesel engines giving a speed of 11 knots will be used.

Guest, Keen & Nettlefolds Limited has received an order from the Argentine North Eastern Railway for 70,000 steel fishbolts and nuts.

Aerodynamic Deflecting Window Light for G.W.R.

James Beresford & Son Ltd. has received orders from the Great Western Railway for a considerable number of sliding lights for railway coaches to the patents of M. Pottier, as manufactured by the Société l'Aerodynamique Industrielle. The construction of these lights was described in the issue of THE RAILWAY GAZETTE for January 12, 1934, pp. 54 and 55, where it was shown that the principles of aerodynamic deflection and pressure balance have been employed in such a way that the incident air is so diverted as to establish zones of reduced air pressure which draw air, dust and water away from the window clearance spaces through which they would otherwise be driven.

Howell & Co. Ltd. has received an order from the Central Argentine Railway for 2,000 Aquacidox galvanised solid drawn steel boiler tubes.

The Egyptian Delta Light Railways Administration has placed the following orders to the inspection of Messrs. Rendel, Palmer & Tritton :—

John Spencer & Son (1928) Ltd., 15 locomotive axles and 50 carriage and wagon axles.
Yorkshire Engine Co. Ltd., eight firebox shells and six axleboxes.

S. A. Gilsoco has received an order from the Bengal North Western Railway for 123,800 fishbolts to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

The Bambairtite Battery Co. Ltd. has received a repeat order from the Madras & Southern Mahratta Railway for 1,000 sac elements for Bambairtite patent Leclanché cells.

Hill & Co. Ltd. has received an order from the Peruvian Corporation for 1,770 solid-drawn steel boiler and superheater smoke tubes.

Vereinigte Deutsche Metallwerke has received an order from the Bombay Baroda & Central India Railway administration to the inspection of Messrs. Rendel, Palmer & Tritton for 35½ tons of copper rods required for locomotive staybolts and rivets.

Yates' Improved Rail Anchor Co. Ltd. has received an order from the Peruvian Corporation for 11,200 improved type rail anchors for 80-lb. rails.

The L.N.E.R., in connection with the programme of rolling stock construction now being carried out, has let the following contracts for fittings and equipment :—

Metropolitan-Cammell Carriage & Wagon Co. Ltd., 3,100 pressed steel wagon ends and 3,100 galvanised ventilator covers.
Vickers Train Lighting Co. Ltd., 168 train lighting dynamos and 1,258 L.N.E.R. standard Planté cells.
J. Stone & Co. Ltd., 425 train lighting dynamos and 3,690 L.N.E.R. standard Planté cells.
Chloride Electrical Storage Co. Ltd., 3,650 L.N.E.R. standard Planté cells.
Pritchett & Gold and E.P.S. Co. Ltd., 3,618 L.N.E.R. standard Planté cells.

The Metropolitan-Cammell Carriage & Wagon Co. Ltd. has received an order from the Bengal-Nagpur Railway for 1,200 axle guards.

Guest Keen & Nettlefolds Limited has received an order from the Central Argentine Railway for 33,000 fishbolts, locknuts and washers.

Skoda Works has received an order from the Bikaner State Railways Administration for 26 locomotive tyres to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

Bayliss, Jones & Bayliss Limited has received an order from the Buenos Ayres Midland Railway for 10,000 fishbolts, locknuts, and washers.

The South Indian Railway Administration has placed the following orders to the inspection of Messrs. Robert White & Partners :

Tempered Spring Co. Ltd., 4,410 helical and volute springs.
Les Ateliers Mechaniques, 250 volute springs.
Worthington Simpson Limited, three electric pumps with motors and starters.
Anderston Foundry Co. Ltd., 210,000 split cotters.

George Spencer Moulton & Co. Ltd. has received an order from the Buenos Ayres Great Southern Railway for approximately 4,000 vacuum brake hosepipes.

The Egyptian Ministry of Finance is calling for tenders, to be presented in Egypt by March 16, for the supply of 55 light railway wagons and 60 rope jockeys. Further particulars of this call for tenders may be obtained from the Department of Overseas Trade.

The Port and Railway Administration of Lourenço Marques is calling for tenders, to be presented in Lourenço Marques by March 5, for the supply of rails, fishplates, switches, bolts, nuts and coachscrews. Further particulars of this call for tenders may be obtained from the Department of Overseas Trade.

Forthcoming Events

Feb. 21 (*Fri.*).—Institute of Transport (Leeds Graduate), at Leeds Transport Department, 7 p.m. "Nationalisation of Transport," by Mr. H. Mann.
Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, 5.30 p.m. Annual General Meeting.
Feb. 24 (*Mon.*).—Institution of Mechanical Engineers (Graduate), Storey's Gate, London, S.W.1, 6.45 p.m. "Locomotive Valve Practice," by Mr. R. Purdie.
Feb. 25 (*Tues.*).—Institute of Transport (Birmingham Graduate), at Imperial Hotel, 6.30 p.m. "Removals—the Need for an Expert," by Mr. F. Grimsley.
L.N.E.R. (Newcastle-Sunderland) Lecture and Debating Society, at Sunderland, 7 p.m. Prize Essay Reading.
L.N.E.R. (York) Lecture and Debating Society, at Railway Inst., Queen Street, 7 p.m. "Leaves from a Yard Master's Note Book," by Mr. J. Ellott.
Permanent Way Institution (Scottish), at Royal Technical College, George Street, Glasgow, 7.15 p.m. "Timber Shoring and Tunnelling in Permanent Way Work," by Mr. P. Sanderson.
Feb. 26 (*Wed.*).—Institution of Locomotive Engineers (Manchester), at Literary Society, 36, George Street, 7 p.m. "Twenty-Five Years of Railway Development," by Mr. Cecil J. Allen.
L.N.E.R. (Darlington), Lecture and Debating Society, at North Road Inst., 7.30 p.m. "Considerations Governing Locomotive Construction," by the Study Circle.
Feb. 27 (*Thurs.*).—Institution of Locomotive Engineers (London), at Inst. of Mechanical Engineers, Storey's Gate, S.W.1, 6 p.m. "Impact of Railway Vehicles in Relation to Buffer Resistance," by Mr. R. Glascodine.
Feb. 28 (*Fri.*).—Diesel Engine Users' Association, at Caxton Hall, Caxton Street, London, S.W.1, 3 p.m. "The Report of the Committee on Heavy Oil Engine Working Costs (1934-5)."
Institute of Transport (Manchester-Liverpool), at Liverpool, 6.30 p.m. "Smalls Traffic—Past, Present and Future," by Mr. W. Finlayson.
Institute of Transport (Newcastle), at Royal Station Hotel, 7.30 p.m. Visit of the President.
Institution of Locomotive Engineers (London), at Trocadero Restaurant, Shaftesbury Avenue, W.1, 6.30 for 7 p.m. Annual Dinner.
L.N.E.R. (King's Cross) Literary Society, at Queen's Hall, Langham Place, London, W.1, 7.30 p.m. Annual Smoking Concert.

Forthcoming Meetings

Feb. 25 (Tues.).—**Liverpool Overhead Railway Company** (Ordinary General), India Buildings, Water Street, Liverpool, at 12 noon.

Feb. 26 (*Wed.*).—**Great Western Railway Company.** (Annual General), Paddington Station, W.2, at 11.30 a.m.

Feb. 27 (*Thurs.*)—**Dundalk, Newry and Greenore Railway Company** (Ordinary General), Euston Station, London, N.W., at 12.30 p.m.

Feb. 27 (*Thurs.*).—**Great Northern Railway Company (Ireland)** (Ordinary Annual General), Grosvenor Minor Hall, Glengall Street, Belfast, at 12 noon.

Feb. 27 (*Thurs.*).—**Southern Railway Company** (Annual General), Southern House, Cannon Street Station, E.C., at 11.30 a.m.

Feb. 28 (*Fri.*)—**London Midland & Scottish Railway Company** (Ordinary General), Friends' House, Euston Road, N.W.1, at 11.30 a.m.

March 4 (*Wed.*).—**London Midland & Scottish Railway Company** (Special General), Euston Station, N.W.1, at 12 noon.

March 6 (*Fri.*).—**London & North Eastern Railway Company** (Ordinary General), Wharncliffe Rooms, Hotel Great Central, Marylebone, N.W.1, at 2 p.m.

OFFICIAL NOTICES

London and North Eastern Railway Company

NOTICE IS HEREBY GIVEN that the Thirteenth Ordinary General Meeting of the Proprietors of the London & North Eastern Railway Company will be held in the Wharncliffe Rooms, Hotel Great Central, Marylebone, London, N.W.1, on Friday, the 6th day of March, 1936, at 2 p.m., for the purpose of the general business of the Company.

NOTICE IS HEREBY FURTHER GIVEN that in accordance with the Standing Orders of Parliament and the General Orders for the regulation of proceedings under and in pursuance of the Private Legislation Procedure (Scotland) Act, 1899, a Special or Extraordinary General Meeting of the Proprietors of the Company will be held at the same place on the same day at 3 p.m., or as soon thereafter as the business of the Ordinary General Meeting is concluded, for the purpose of considering and, if thought fit, of approving—

(*a*) Bills which the Company have introduced into Parliament, intituled:—

"A Bill to empower the London & North Eastern Railway Company to widen certain of their Railways; to construct other works in connection with their undertaking and to acquire Lands; to revive the powers and extend the time for the completion of certain Railways; to raise money for or in connection with passenger transport services in the London Transport Area; and for other purposes."

"A Bill to empower the London & North Eastern Railway Company to widen certain of their Railways to construct other Works in connection with their undertaking and to acquire Lands; to authorise financial arrangements with respect to certain works and facilities to be provided by the said Company under an Agreement with the Treasury; to raise additional capital; to dispose of or close the Grantham Canal; and for other purposes."

(*b*) A draft Provisional Order for which application has been made by the Company to the Secretary of State for Scotland, intituled:—

"Draft Provisional Order to empower the London & North Eastern Railway Company to acquire additional Lands; to make provision as to the tolls and charges leviable by the said Company on the Edinburgh and Glasgow Union Canal; and for other purposes."

(*c*) A Bill, promoted by the London Passenger Transport Board, which has been introduced into Parliament, intituled:—

"A Bill to empower the London Passenger Transport Board to provide certain services of trolley vehicles; to construct new works; to acquire Lands; to raise additional moneys; to confer further powers on the Board; and for other purposes"

and

(*d*) A Bill, promoted by the Great Western Railway Company, which has been introduced into Parliament, intituled:—

"A Bill to empower the Great Western Railway Company to construct railways and to acquire Lands; to authorise financial arrangements with respect to certain works and facilities to be provided by the said Company under an agreement with the Treasury in connection with passenger transport services in the London Transport Area and to raise additional capital; and for other purposes."

Dated this 19th day of February, 1936.

By Order,
JAMES McLAREN,
Secretary.

Marylebone Station,
London, N.W.1.

South Indian Railway Company Limited

THE Directors are prepared to receive Tenders for the supply of:—

ANTI-CORROSIVE PAINT.

Specifications and Forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Company Limited, marked "Tender for Anti-Corrosive Paint," with the name of the firm tendering, must be left with the undersigned not later than 12 Noon on Friday, the 28th February, 1936.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 5s. for each copy of the Specification.

E. A. S. BELL,
Managing Director.

91, Petty France,
Westminster, S.W.1.
19th February, 1936.

London Midland and Scottish Railway Company

NOTICE IS HEREBY GIVEN that a Special General Meeting of the London Midland & Scottish Railway Company will in compliance with the Standing Orders of Parliament be held at Euston Station, London, N.W.1, on Wednesday, the 4th day of March, 1936, at 12 o'clock Noon precisely, for the purpose of considering, and if so determined, of approving the undermentioned Bills, namely:—

BILL PROMOTED BY THE COMPANY. DEPOSITED IN PARLIAMENT.

LONDON MIDLAND & SCOTTISH RAILWAY BILL.

A Bill to empower the London Midland & Scottish Railway Company to construct works and to acquire lands; to authorise financial arrangements with respect to certain works and facilities to be provided by the said Company under an Agreement with the Treasury; and for other purposes.

BILLS PROMOTED BY OTHER PARTIES. DEPOSITED IN PARLIAMENT.

LONDON PASSENGER TRANSPORT BOARD BILL.

A Bill to empower the London Passenger Transport Board to provide certain services of trolley vehicles; to construct new works; to acquire lands; to raise additional monies; to confer further powers on the Board; and for other purposes.

SOUTHERN RAILWAY BILL.

A Bill to empower the Southern Railway Company to construct works and acquire lands; to extend the time for the compulsory purchase of certain lands; to empower the said Company and the London Midland & Scottish Railway Company to construct certain works; to authorise financial arrangements with respect to certain works and facilities to be provided by the Southern Railway Company under an Agreement with the Treasury; to raise additional capital; and for other purposes.

JOSIAH CHARLES STAMP,
Chairman.
OWEN GLYNNE ROBERTS,
Secretary.

Euston Station,
London, N.W.1.
17th February, 1936.

Railway Materials & Equipment Manufacturers

ADVERTISER desires active Directorship in an established concern, Birmingham or London Districts. Previous works and selling experience among Home and Foreign Railways. Good connection rolling stock builders, &c. Could probably introduce a strong Sales Organisation if required. Age 45. Audited accounts essential. Capital available, £10,000. Please communicate with DOCKER, HOSGOOD & Co., 10, Newhall Street, Birmingham, in first instance.

THE MADRAS & SOUTHERN MAHRATTA RAILWAY COMPANY LIMITED invite Tenders for:—

SIX 10-TON HAND-POWER TRAVELLING CRANES.

Specification and Form of Tender can be obtained at the Company's Offices, 25, Buckingham Palace Road, Westminster, London, S.W.1. Fee One Guinea *which will not be returned.*

Tenders must be submitted not later than 2 o'clock p.m. on TUESDAY, 10TH MARCH, 1936.

The Directors do not bind themselves to accept the lowest or any Tender and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
G. W. V. DE RHE PHILIPE,
Secretary.

ASSOCIATED BRITISH MACHINE TOOL MAKERS LIMITED require Representative for their Calcutta Office. Good knowledge of machine tools essential. Write GENERAL MANAGER, 17, Grosvenor Gardens, London, S.W.1, stating experience, age and salary.

PATENTS for Inventions, Trade Marks, Advice, Handbook, and consultations free. King's Patent Agency, Ltd. (B. T. King, C.I.M.E., Registered Patent Agent, G.B., U.S., and Canada). 146A, Queen Victoria Street, London, E.C.4. 50 years' references. 'Phone City 6161.

The Bengal & North Western Railway Company Limited

THE Directors are prepared to receive Tenders for the supply of:—

22,800 TUNGSTEN FILAMENT LAMPS

as per Specification to be seen at the Company's Offices.

Tenders addressed to the undersigned, and envelope marked "Tender for Lamps," with name of firm tendering, to be lodged not later than Noon on the 10th day of March, 1936.

For each Specification a fee of 10s. will be charged which cannot, under any circumstances, be returned.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
W. R. IZAT,
Managing Director.

237, Gresham House,
Old Broad Street,
London, E.C.2.
19th February, 1936.

Crown Agents for the Colonies

COLONIAL GOVERNMENT APPOINTMENTS

APPLICATIONS from qualified candidates are invited for the following post:—

ASSISTANT ENGINEER required by the Government of Nigeria for the Railway Department for two tours of 12 to 18 months. Salary £540—£30—£720 a year. Free passages and quarters and liberal leave on full salary. Candidates, aged 23 to 35, must be Corporate Members of the Institution of Civil Engineers and be experienced in bridge and reinforced concrete construction.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/4051.

Traction

LARGE concern requires for leading position an Electrical Engineer with extensive experience in traction matters, more particularly operating conditions and motor construction. Apply giving full details, experience, training, and salary required, to Box No. 20, c/o THE RAILWAY GAZETTE, 33, Tothill Street, London, S.W.1.

Railway and Other Reports

Beira Railway.—A dividend is recommended of 1s. 6d. a share, less tax at 2s. 8d. in the pound, in respect of the 12 months ended September 30, 1935. The last dividend paid was for the year ended September 30, 1930.

Bengal Dooars Railway. — The directors have declared an interim dividend of 3 per cent. on the ordinary stock, on account of the year ending March 31, 1936, payable, less income tax at 2s. 4d. in the £, on March 26, 1936.

Birmingham Railway Carriage & Wagon Co. Ltd.—Trading for the year ended December 31, 1935, shows a profit of £3,326, as against a loss of £12,767 for the previous year. After charging interest on debenture stock, directors' fees, and interim dividend paid on the preference shares last August and including £57,645 brought in, there is a balance of £53,814 available for distribution. The directors recommend a dividend of 1s. a share (5 per cent. per annum), less tax, on the ordinary shares, leaving £13,089 to be carried forward. For the previous year the same dividend was paid but the sum of £87,500 was taken from reserve.

Railway Share Market

The stock and share markets have been very active, but partly owing to the fact that chief interest centred on iron, steel and aircraft shares. Home railway stocks attracted less attention. In most instances they are lower on the week owing to profit-taking by holders who purchased before the rises established prior to last week's good dividend announcements. There is a disposition to await the statements at the annual meetings, particularly for references to the extent of the importance of the rating decision.

L.N.E.R. first preference was bought prior to the dividend announcements on the view that if the full 4 per cent. dividend were paid the yield offered would appear attractive. Southern preferred came in for profit-taking, but the lower price is partly due to the price being "xd." Despite the good impression created by the annual report, L.M.S. stocks reflected the general tendency. London Transport "C" weakened further. Various Argentine railway stocks have improved fractionally on the more favourable treatment the companies are to receive in the matter of exchange. B.A.G.S. Central Argentine and various of the other "leading" ordinary stocks were more active, but chief interest was inclined to centre on the preference stocks, it being realised that the dividend prospects of the latter stocks are improved to some extent by the exchange decision. The market is, however, not expecting anything of a revival in Argentine railway stocks until there is a really good increase in traffic receipts, and then it is said the response in prices might be substantial.

Cordoba Central debentures were in request at higher prices. San Paulo continued in demand, and there was again buying of Antofagasta and Nitrate rails in evidence. Although best prices were not maintained, the increased interest in Canadian Pacific was continued and the preference and debenture stocks are fractionally higher. There is talk in some quarters that resumption of dividends on the preference is quite possible this year, but there would apparently have to be a very large advance in traffics to permit of this. Among American railroad stocks Union Pacific has moved up several points.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1935-36	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1935	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1935	Prices: Lowest 1935	Prices: Feb. 19, 1936	Yield (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili)&Bolivia	834	16.2.36	13,590	– 260	7	99,800	82,600	+ 17,200	Ord. Stk.	23	14 15/16	24 1/2	Nil
	Argentine North Eastern ..	753	15.2.36	7,064	+ 29	33	258,265	239,957	+ 18,308	,,	7	4	6	Nil
	Argentine Transandine ..	—	—	—	—	—	—	—	—	A. Deb.	49 1/2	30	50	8
	Bolivar	174	Jan., 1936	5,500	– 350	5	5,500	5,850	– 350	6 p.c. Deb.	13	5	10	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	14	11	14	39/13
	Buenos Ayres & Pacific ..	2,806	15.2.36	101,527	+ 7,020	33	2,592,993	2,344,602	+ 248,391	Ord. Stk.	101 1/2	47 8	10	Nil
	Buenos Ayres Central ..	190	1.2.36	$101,700	+ $14,000	31	$3,651,500	$3,547,100	+ $104,400	Mt. Deb.	21	10	17 1/2	Nil
	Buenos Ayres Gt. Southern	5,085	15.2.36	170,288	– 36,977	33	4,172,616	4,485,348	– 312,732	Ord. Stk.	27	13 1/2	22	Nil
	Buenos Ayres Western ..	1,930	15.2.36	51,674	– 1,486	33	1,424,004	1,415,375	+ 8,629	,,	24	10	17	Nil
	Central Argentine	3,700	15.2.36	138,503	+ 5,945	33	3,995,495	3,886,480	+ 109,015	,,	17 7/8	7	13	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	9	3 1/4	6 1/2	Nil
	Cent. Uruguay of M. Video	273	1.2.36	13,725	+ 2,063	31	318,424	467,419	– 148,995	Ord. Stk.	8 1/2	3	7	Nil
	Do. Eastern Extn.	311	1.2.36	2,843	+ 501	31	58,272	57,469	+ 803	—	—	—	—	—
	Do. Northern Extn.	185	1.2.36	1,496	+ 274	31	41,408	31,020	+ 10,388	—	—	—	—	—
	Do. Western Extn...	211	1.2.36	1,173	+ 213	31	26,245	24,180	+ 2,065	—	—	—	—	—
	Cordoba Central	1,218	15.2.36	25,540	+ 1,200	33	962,790	964,000	– 1,210	Ord. Inc.	4	1	3	Nil
	Costa Rica	188	Dec., 1935	12,022	– 6,024	26	80,721	99,051	– 18,330	Stk.	35	30	34	57/8
	Dorada	70	Jan., 1936	13,300	+ 2,800	5	13,300	10,500	+ 2,800	1 Mt. Db.	103 5/8	102 1/2	103 1/2	5 11/13
	Entre Rios	810	15.2.36	10,294	– 2,901	33	369,093	417,297	– 48,204	Ord. Stk.	15	6 1/2	11	Nil
	Great Western of Brazil ..	1,082	15.2.36	10,900	– 200	7	69,900	78,500	– 8,600	Ord. Sh.	1/2	3/1	5/8	Nil
	International of Cl. Amer.	794	Dec., 1935	$458,840	+ $47,975	52	$4,717,930	$4,722,778	– $4,848	—	—	—	—	—
	Interoceanic of Mexico ..	—	—	—	—	—	—	—	—	1st Pref.	1/2	3/32	1/2	Nil
	La Guaira & Caracas ..	22 1/4	Jan., 1936	4,425	+ 1,325	5	4,425	3,100	+ 1,325	Stk.	8 1/2	8	8 1/2	Nil
	Leopoldina	1,918	15.2.36	19,308	+ 3,095	7	130,108	120,372	+ 9,736	Ord. Stk.	8 1/2	2 1/2	8 1/2	Nil
	Mexican	483	14.2.36	$253,100	– $45,900	7	$1,549,100	$1,528,200	+ $20,900	,,	1 1/2	1/4	1 1/4	Nil
	Midland of Uruguay ..	319	Dec., 1935	7,995	– 5,513	26	38,696	65,833	– 27,137	,,	1 1/2	1 1/8	1 1/2	Nil
	Nitrate	401	15.2.36	4,402	– 4,811	7	23,461	19,173	+ 4,288	Ord. Sh.	64/–	42/–	2 1/4	Nil
	Paraguay Central	274	8.2.36	$2,253,000	+ $1,050,000	32	$66,750,000	$32,374,000	+ $34,376,000	Pr. Li. Stk.	80 1/2	60	77	7 13/16
	Peruvian Corporation ..	1,059	Jan., 1936	83,119	+ 17,810	31	537,416	436,825	+ 100,591	Pref.	10 5/8	6 7/16	14	Nil
	Salvador	100	8.2.36	£30,900	– £10,600	32	£544,396	£542,752	+ £1,644	Pr. Li.Db.	65	61	65	7 11/16
	San Paulo	153 1/2	9.2.36	28,583	+ 8,350	6	158,750	121,945	+ 36,805	Ord. Stk.	80	35	66 1/2	3 3/4
	Taltal	164	Jan., 1936	3,215	– 657	31	23,915	17,442	+ 6,473	Ord. Sh.	1 11/16	1 1/8	1 5/8	7 1/4
	United of Havana	1,353	15.2.36	46,155	– 4,722	33	585,539	618,875	– 33,336	Ord. Stk.	3 1/16	1	3	Nil
	Uruguay Northern	73	Dec., 1935	1,086	– 442	26	4,719	7,294	– 2,575	Deb. Stk.	4 1/2	2 15/16	4 1/2	Nil
Canada.	Canadian National	23,684	14.2.36	609,456	– 7,496	7	3,758,983	3,639,067	+ 119,916	—	—	—	—	—
	Canadian Northern ..	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	78 3/8	52 1/2	67 1/2	5 15/16
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	103 5/8	93	104 1/2	3 13/16
	Canadian Pacific	17,260	14.2.36	436,800	– 12,800	7	2,737,600	2,539,400	+ 198,200	Ord. Stk.	14 1/16	8 3/4	15	Nil
India.†	Assam Bengal	1,329	20.1.36	37,230	– 4,959	42	1,005,432	1,141,167	– 135,735	Ord. Stk.	92 1/8	77 1/2	82 1/2	3 5/8
	Barsi Light	202	20.1.36	3,780	+ 150	42	114,480	114,150	+ 330	Ord. Sh.	105	77 1/2	75 1/2	6 11/16
	Bengal & North Western ..	2,112	31.1.36	91,920	– 7,336	43	879,488	875,353	+ 4,135	Ord. Stk.	301 1/2	291	303 1/2	5 1/4
	Bengal Dooars & Extension	161	20.1.36	3,897	– 969	42	114,386	128,736	– 14,350	,,	127 1/2	122	125 1/2	5 9/16
	Bengal-Nagpur	3,268	10.1.36	186,000	+ 9,629	41	4,925,027	4,541,724	+ 383,303	,,	105	100 5/16	102 1/2	3 7/8
	Bombay, Baroda & Cl. India	3,072	10.2.36	264,600	– 20,700	45	6,987,150	7,108,125	– 120,975	,,	115 1/4	110	112 1/2	5 5/16
	Madras & Southern Mahratta	3,230	20.1.36	141,900	+ 5,787	42	4,266,522	4,473,948	– 207,426	,,	128 1/2	113 7/8	115 1/2	7 1/4
	Rohilkund & Kumaon ..	572	31.1.36	20,010	+ 1,405	43	168,297	170,838	– 2,541	,,	294	262	295 1/2	5 7/16
	South India	2,526	20.1.33	102,626	– 1,207	42	3,169,853	3,326,286	– 156,433	,,	119 3/4	104 1/4	106 1/2	7 1/16
Various.	Beira-Umtali	204	Dec., 1935	63,267	+ 7,772	13	193,193	180,985	+ 12,208	—	—	—	—	—
	Bilbao River & Cantabrian	15	Jan., 1936	1,317	– 932	5	1,317	2,249	– 932	—	—	—	—	—
	Egyptian Delta	622	31.1.36	7,567	– 514	43	212,780	203,124	+ 9,656	Prf. Sh.	2	15/8	1 5/4	5 11/16
	Great Southern of Spain ..	104	8.2.36	1,225	– 751	6	7,610	12,774	– 5,164	Inc. Deb.	3 1/2	2	3 1/2	Nil
	Kenya & Uganda	1,625	Nov., 1935	182,196	+ 11,855	48	2,184,339	2,030,213	+ 154,126	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	48	36	48 1/2	7 1/16
	Mashonaland	913	Dec., 1935	99,331	– 10,413	13	313,033	342,255	– 29,222	1 Mg. Db.	104 1/4	100	103 1/2	4 13/16
	Midland of W. Australia ..	277	Dec., 1935	14,842	+ 324	26	83,624	85,948	– 2,324	Inc. Deb.	98 1/4	93	94 1/2	5 5/16
	Nigerian	1,905	28.12.35	44,590	+ 2,880	39	1,312,173	1,402,815	– 90,642	—	—	—	—	—
	Rhodesia	1,538	Dec., 1935	185,464	+ 3,848	13	575,986	556,652	+ 19,334	4 p.c. Db.	105 1/2	101	104 1/2	3 13/16
	South African	13,246	25.1.36	577,353	+ 24,435	43	24,438,946	22,131,621	+ 2,307,325	—	—	—	—	—
	Victoria	4,728	Sept., 1935	789,330	+ 82,793	13	2,238 853	2,139,677	+ 99,176	—	—	—	—	—
	Zafra & Huelva	112	Dec., 1935	10,725	+ 139	52	134,755	138,474	– 3,719	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rates of exchange and not on the par value

Diesel Railway Traction

New Zephyrs for Long-Distance Work

THE success of the three-car stainless steel Burlington Zephyr, costing £70,000, and its successors the Twin Zephyrs and the *Flying Yankee*, costing £55,000 apiece, appears to have been more than sufficient to offset the high outlay—which is well over twice the price of a European streamlined diesel train of equal capacity. In addition to the *Mark Twain*, the four-car train set to work in October last, the Burlington Railroad now has on order four further trains, viz., two seven-car units and two ten-car, so apparently the Shot-welded stainless steel construction of the framework and body has stood up to its work despite its light weight. The use of stainless steel has sundry other advantages, such as elimination of painting and reduction in cleaning costs, which justify its use although the cost, as stated by Messrs. Coverdale & Colpitts, the American consulting engineers in a report on the Burlington Zephyr, is £185 per ton, and accounts for about 7 per cent. of the selling price of a train. Its use is not confined to the Burlington line, and within the next twelve months at least 30 train sets and 3 single cars will be running, including the 20 electric trains now being built for the French State Railways. Despite the novelty of the construction, the principal advantage of the Zephyr trains is that possessed by other streamlined diesel trains, viz., their capability of maintaining fast schedules over light or heavy tracks at a fraction of the operating cost and with about half the weight of a steam train of the same capacity. Moreover, the rapid acceleration and deceleration rates prevent the train becoming such a nuisance to the timetable department when a path through a congested area is being found for a flyer. As regards operating costs, the original Zephyr has been running at a cost of approximately 17d. per train-mile, and compared with the previous steam train, saves the railroad about £10,500 a year in operating charges. The working cost per train-mile of the Twin Zephyrs is even lower, due to their great daily mileage, 862, and to the exceedingly satisfactory performance they have put since going into service between Chicago and the Twin Cities in April, 1935.

Pistons, Rings and Lubrication

THE correct application of oil to the pistons and cylinder liners is not one of the minor points in the lubrication of a diesel engine, and there is a close interdependence between the design and construction of the piston and its rings and the efficacy of the lubrication and the consumption of the oil. The clearance of the piston and the design and pressure of the rings against the liner are matters of prime importance, not only because of lubrication and leakage but also because of the function of the piston and its rings as heat transmitters. Normally, the liner shows greatest wear at the top, and it is here that the rings have the greatest clearance or least pressure. It is here, also, that the maximum sealing effect is required, for it is flame with a temperature of about 2,800° F. which must be kept back, whereas in lower piston positions it is hot air with a temperature of well below 1,000° F. or burnt gases at 1,000-1,600° F. which must be sealed. Flame leakage near the top dead centre burns off the oil film below the top piston ring, giving metal to metal contact, and increasing the temperature of the liner, piston, and ring both directly and by the increased friction. The leakage of lubricating oil from the crankcase into the combustion chamber is a further problem, which is supposed to be dealt with by the scraper rings, although some amelioration is gained by relatively low oil temperature and pressure. Nevertheless, the top of the liner needs lubrication, and some leakage into the combustion chamber must take place. Part of this oil is burned during each explosion and sticks to the liners and rings in the form of carbon residue. This residue may increase to such an extent, under certain conditions, as to bind the rings and render them inoperative, and the possibility of such a happening forms one of the main reasons for the limitation of the carbon residue in lubricating oil specifications. With a carbon residue of under 0·1 per cent. fouling of the rings is rare, but it is probable that over lubrication has caused just as much trouble by carbonisation as unsuitable brands of oil, and it is certainly a more frequent fault than under lubrication. Best modern practice shows a guaranteed lubricating oil consumption of 1 to 1¼ per cent. that of the fuel by weight, and successful running over long periods with a consumption of under 1 per cent. is not unknown with the railway type of oil engine. But not infrequently the lubricating oil bill amounts to over 25 per cent. that of the fuel charges, and as efficient lubrication is important both technically and financially, we believe that the article by Mr. H. C. Gill, published on the three succeeding pages, will be read with interest by a wide variety of railway men.

Coal and Oil

IT is a curious commentary on the progress of science, and on the fact that probably 90 per cent. of the inventions since the first man strung his hickory bow have been made with the object of reducing the sweat of the brow, that industrialists should so often be engaged in commercial and wordy wars against the latest and most efficient products of scientists and engineers, which might reasonably be supposed to act for the betterment of the human race. The latest tirade comes from none other than a director of the Coal Utilisation Council, who is apprehensive that diesel railway traction may spoil his sales, and he has revealed in a letter to the press that a certain railway company runs a streamlined steam train "because it is [thus] able to run a train about double the weight of the *Flying Hamburger*." He omits to state that the seating capacity is only 45 per cent. greater, but in any case, the weight of the train (including the engine) in question actually is more than four times that of the *Flying Hamburger*. Were it not for this coal question (so-called) the use of diesel vehicles on British railways would be much greater than it is, for there is no question that the *real* efficiency of the diesel vehicle is much higher than that of even the most efficient steam engine. What would be much more appropriate to question is the philosophy behind the persistent advocacy of a means of propulsion that involves an unnecessarily high expenditure of energy.

The Economic Lubrication of High-speed and Medium-speed Engines for Diesel Traction

By H. C. GILL

LUBRICATION of high-speed and medium speed diesel engines of the four-stroke trunk-piston type has given little trouble. Provision for the delivery at high pressure of an abundant supply of well filtered oil to the crankshaft bearings and other lubricated points ensures that in normal circumstances no failure of the system causing mechanical breakdown will occur. The tendency to over-lubrication has sometimes resulted in high consumption due to inability to control the large amount of oil in circulation, arising mainly from the absence of adequate means for stripping the cylinder walls of excess oil by the use of efficient scraper rings.

The following notes concern engines which are lubricated on the dry sump principle. In a normal arrangement for this type of engine, see Fig. 1, the oil is led from the storage tank to the pressure pump which delivers it through a filter to the main oil rail feeding the crankshaft bearings, and to the other supply points for the camshaft bearings, valve rockers, tappets and gearing. The oil, draining into the engine sump at the lowest point in the bedplate, is withdrawn by a scavenge pump, fully 25 per cent. greater in capacity than the pressure pump, and delivered through a second filter to the cooler whence it is discharged to the storage tank. This arrangement provides for a minimum quantity of oil being contained in the sump when running. The pistons are splash lubricated and the gudgeon pins also rely upon splash, the pipe feeding oil from the big end to the small end bearing having been found unnecessary.

The capacity of the pressure pump is such that a large amount of surplus oil is always by-passed through a relief valve, set to the desired working pressure, to the engine sump. The quantity actually delivered to the crankshaft bearings alone is difficult to estimate but it must constitute a very large proportion of the total amount in circulation. A normal rate of circulation in such a lubricating system varies from 0·05 to 0·10 gal. per min. per b.h.p. and this covers all lubrication required, including the negligible amount of oil necessary for operating any governor relay mechanism which may be fitted. The explanation of the great difference existing in the oil pump capacities of different engines is due to the practice of making provision in those of recent design for a greater surplus output, and lubrication of additional gears and bearings. Originally it was the practice—still maintained in many equipments—to use high pressure lubrication, the pressure being 35 to 45 lb. per sq. in. at the lowest pressure point in the system, but this has been almost abandoned and a low pressure of 10 to 12 lb. per sq. in. substituted. This is more reliable and satisfactory, providing the oil ducts and channels are adequate in area.

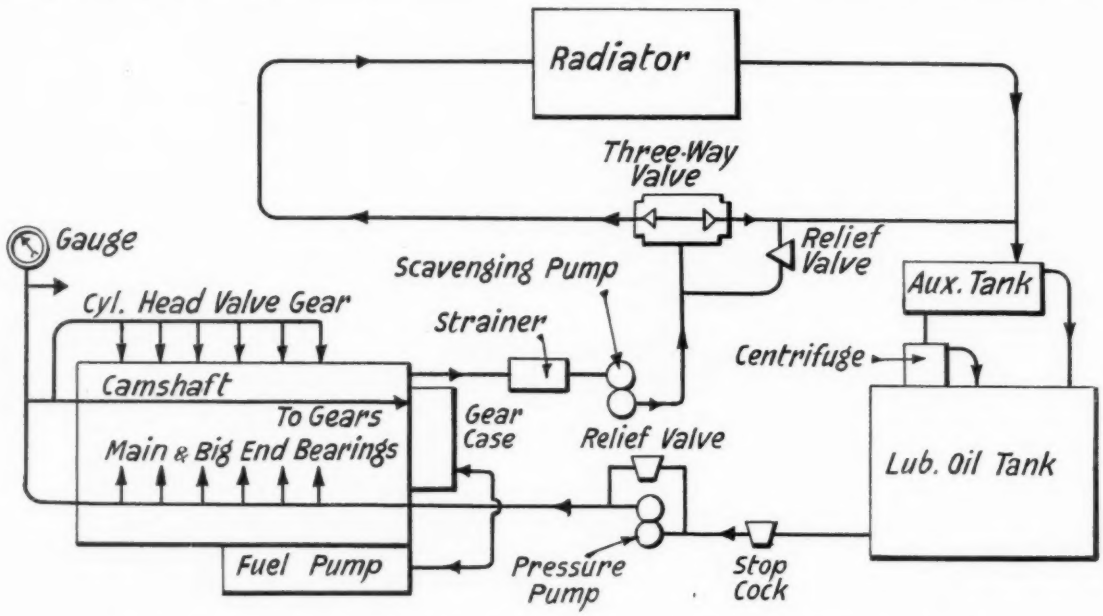


Fig. 1—A typical lubricating oil circuit for a medium-speed (750 to 1,000 r.p.m.) engine

The temperature of the oil leaving the crankpins may be 180° F. with safety, and this is probably an average figure when working at full load and speed. An average discharge temperature from the engine is 140° F. cooled down to approximately 125° F. It is good practice to lower these temperatures if possible, not on account of the bearings, but because of the beneficial effect on the oil consumption. Ample cooling of the bearings is ensured with low pressure lubrication at the temperatures and rate of oil circulation given.

Much attention has always been given to reducing the oil consumption to an economic figure. The cost of lubricating oil becomes a heavy operating charge in railway

service if the amount used greatly exceeds 5 per cent. of the fuel consumption. An engine of modern design should operate on a consumption of lubricating oil well within 3 per cent. of that of the fuel, without taking into account any saving gained by the reclamation of oil with a cleaning plant. Numerous records exist of engines running at 700-800 r.p.m. with a lubricating oil consumption of approximately 1·0 per cent. that of the fuel consumption, but records taken from 18 railcars on one system for the year 1934 showed that the ratio of lubricating oil to fuel used was 4 per cent., and with a good grade of oil this represents approximately 35 per cent. of the fuel cost. These particular engines have been in service about eight years and experience gained with them indicates that a lower consumption of oil can be guaranteed with more modern types whereby the cost should not exceed 15 to 20 per cent. that of the fuel. A still greater saving can be effected by the use of a high grade oil, frequently changed and passed through a renovator, a procedure which soon recovers the cost of the renovating plant.

Comprehensive experiments directed towards a reduction in oil consumption showed that several factors exist which have a direct influence on this, the most important of which are:—

a. The design and arrangement of the scraper rings.
b. Piston skirt clearance.
c. Piston ring clearances.
d. Pressure, temperature and quantity of oil in circulation.
e. Crankshaft bearing clearances.
f. Length of main journal bearings.

(*a*) High-speed engines with cylinders of, say, 6½ in. diameter and upwards require not fewer than three scraper rings, two below and one above the gudgeon pin; large cylinders probably require four. A group of nine 320 b.h.p. engines which for a period of five years had a particularly high oil consumption, were fitted with pistons of improved design having the arrangement of scraper rings indicated in Fig. 2. This modification had the effect of reducing the consumption to one-fifth, and the improvement has been maintained for nearly three years. The same arrangement has been applied to many other units with equal success and it has been observed that in high-speed engines where a large quantity of oil is discharged into the crank chamber and thrown up into the cylinders by the cranks and connecting rods, the provision of several efficient scraper rings is essential.

Of all the types tried out, grooved and slotted rings have proved most effective. The slots should be short in length and the width of the ring sufficient to provide a good bridge of metal where the slot cuts through the former, otherwise signs of collapse are apparent at this point. The drainage holes leading from the ring grooves to the inside of the piston should be almost the width of the groove in diameter, and, like those disposed below the bottom ring, drilled horizontally and not at an angle. It is important to observe that where the holes break through on the inside of the piston a plain more or less vertical surface is presented, and not a corner, the nature of which serves to act as a receptacle for the oil which would be forced back through the holes due to inertia when the piston changes its direction. The area of the ring slots and holes should be the maximum obtainable consistent with maintaining the strength of the rings and piston. Satisfactory wall pressures for the scraper rings are 14 to 18 lb. per sq. in. and 7 to 9 lb. per sq. in. for gas rings.

(*b*) Excessive running clearance between the piston and cylinder causes the oil consumption to increase, and the minimum that can be adopted with safety can be determined only by careful experiment. The amount per inch of diameter of the piston varies on different engines, being

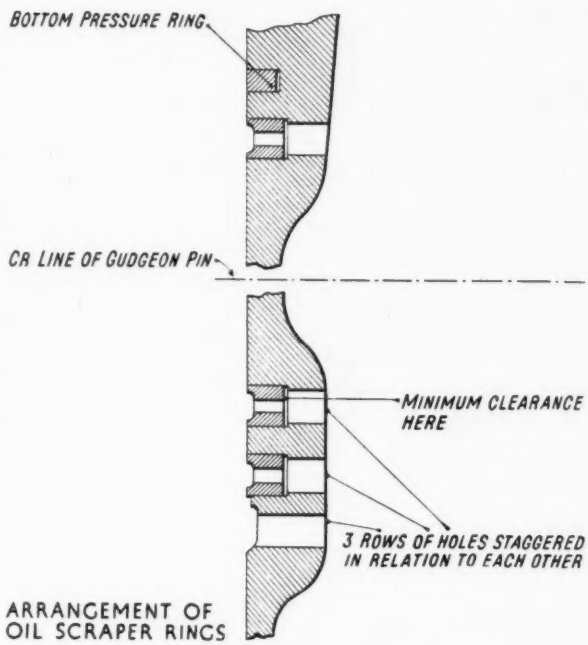

BOTTOM PRESSURE RING
CR LINE OF GUDGEON PIN
MINIMUM CLEARANCE HERE
3 ROWS OF HOLES STAGGERED IN RELATION TO EACH OTHER
ARRANGEMENT OF OIL SCRAPER RINGS

Fig. 2—Arrangement of oil scraper rings

governed by such factors as rating, speed, and material employed. For variable-speed work it will be clear that there are many occasions on which the engine is operating under conditions where the clearances are too great for the load carried, especially at reduced revolutions. This cannot be avoided and militates against a really low consumption under all running conditions. It is therefore important to establish the minimum clearance that can be employed for maximum load and speed. An average figure appears to be 0·002 in. per in. of diameter when using Y alloy pistons. Nevertheless, the consumption on a horse-power basis is always progressively less as the engine revolutions fall because the amount of oil circulated is automatically reduced and the scraper rings are able to deal with it more effectively.

(*c*) The piston rings in all circumstances must work freely in their grooves and it is a mistake to fit these with too fine a clearance. A ring that is quite free during assembly is not necessarily so when subjected to the conditions of temperature and stress obtaining in the cylinder. Warping of the piston lands cannot be avoided, particularly if these are narrow and the material employed is aluminium alloy. This causes binding, resulting in oil loss, heavy wear, and breakage of the rings.

The clearance at the ring butts is also important, and a liberal allowance at this point can do no harm. Butting of the ends due to expansion wedges the ring and prevents lateral movement which sets up heavy wear and consequent loss of oil. The clearance between the inner diameter of the rings and the bottom of the grooves in the piston should be little more than the amount necessary to allow for expansion. This applies to both the gas and scraper rings but particularly the latter. A large clearance at this point accentuates the pumping action of the ring and has a marked effect on oil consumption.

(*d*) The minimum quantity of oil which can be circulated with safety has been difficult to establish, but tests carried out on a large number of engines of widely different types have shown that, provided the temperature of the oil can be kept within the figures previously stated, a

pressure as low as 7 lb. per sq. in. can be used safely. An ample margin is provided with 10 to 12 lb. per sq. in., this reading being taken where it is lowest, at the extreme end of the main pressure rail. Under these conditions the amount of oil to be dealt with by the scraper rings is still large and the quantity in circulation is therefore governed by the temperature and reasonable working pressure which can be employed. Cooling of the oil down to 100° F., or even less, with a discharge temperature from the engine of 115° to 120° F. causes a marked drop in consumption as the rate of circulation falls and the viscosity is higher, both factors contributing to the improvement. To reduce the rate of circulation to the absolute minimum would involve the provision of exceptional cooling facilities, but it is a wise precaution to provide a cooler of ample capacity in the installation, rather than cut the size down to the bare requirements, even at the expense of a slight increase in weight and cost. The saving in oil arising from the use of low temperature lubrication is so marked and the influence on running costs so important that the slight extra cost initially involved is more than justified. With exceptionally low temperatures, the oil economy would be remarkably good, but under the practical conditions cited the quantity of oil circulated is such that it can only be dealt with effectively by the number and arrangement of scraper rings illustrated.

(*e*) It has been established that the diametral clearances of the main journal and the big-end bearings need not exceed 0·0005 in. per in. of shaft diameter. This is the maximum allowed, and it will be appreciated that any increase in this amount will result in the circulation of a greater quantity of oil in order to maintain the working pressure. If the bearing clearances are excessive, the quantity of oil thrown into the cylinders is more than the normal number of scraper rings can deal with and a high consumption is inevitable. Bearings adjusted to a clearance as small as that indicated will maintain it for long periods provided that the engine is carefully run in on the test bed.

(*f*) The effort to reduce engine size and weight almost invariably results in the main bearings being short in length, and it has been observed that the rate of oil discharge from these is great as compared with long bearings. The oil which is discharged on to the crankwebs is thrown off the latter at high velocity and this is a most fruitful source of oil loss. It is notable that in automobile engines the oil consumption is higher where there is a bearing between each crank as compared with those having two or more cranks between each pair of bearings. In high-powered rail traction engines a bearing between each crank is essential, and where these are short care must be taken in their design to prevent as far as possible excessive end leakage by the adoption of fine clearances, the elimination of large gaps at the joint, and the avoidance of unnecessarily large recesses for oil. It is sometimes the practice in the case of big-end bearings to collect the oil, discharged from each end, into catchers fixed to the crankwebs and so designed that the oil is flung off these clear of the cylinder bore to the sides of the crank chamber. Unless the points of the oil throwers rotate in a path well outside the diameter of the cylinder their use is more harmful than beneficial.

Fig. 3—Auto-Klean filter for lubricating oil

General Notes

The importance of surface finish and dimensional accuracy of the cylinder bores is well understood and where wet liners of thin steel section are employed particular attention has to be given to these points. The interference fits, where the liners are located in the crankcase at the top and bottom, have to be closely controlled, and the adjustment to the tension and fit of the rubber rings, which form the water joint at the lower belt, is important if ovality of the liner bores is to be avoided. On the whole, liners of this type have been very successful in spite of the care required during assembly, while they possess the merit of easy extraction and replacement which is desirable where rapid and easy maintenance are concerned.

The desirability of a favourable power-weight ratio forces the designer to compress the engine into the smallest possible bulk and the walls forming the crank chamber are very close to the running gear, the working clearance being small. This feature increases the difficulty of reducing the consumption, as the oil discharged from the crankshaft bearings cannot easily be directed out of the path of the moving parts. Short connecting rods adopted to reduce the height and weight of the engine preclude the fitting of fixed splash guards shielding the opening of the cylinder, due to the pistons approaching close to the crankwebs at the bottom of their stroke.

Matters are made still more difficult if the bottom of the crank chamber, formed by the base of the bedplate, is close to the crank when the latter is on the bottom dead centre, but generally this can be avoided. The practice of arranging the outline of the lower part of the crankcase to hug the path of the connecting rod, leaving a small clearance, is fatal to the interests of a good oil consumption. Considerable depth and space are necessary below the centre line of the crankshaft so that oil once thrown clear of the crankpin and webs cannot be picked up again.

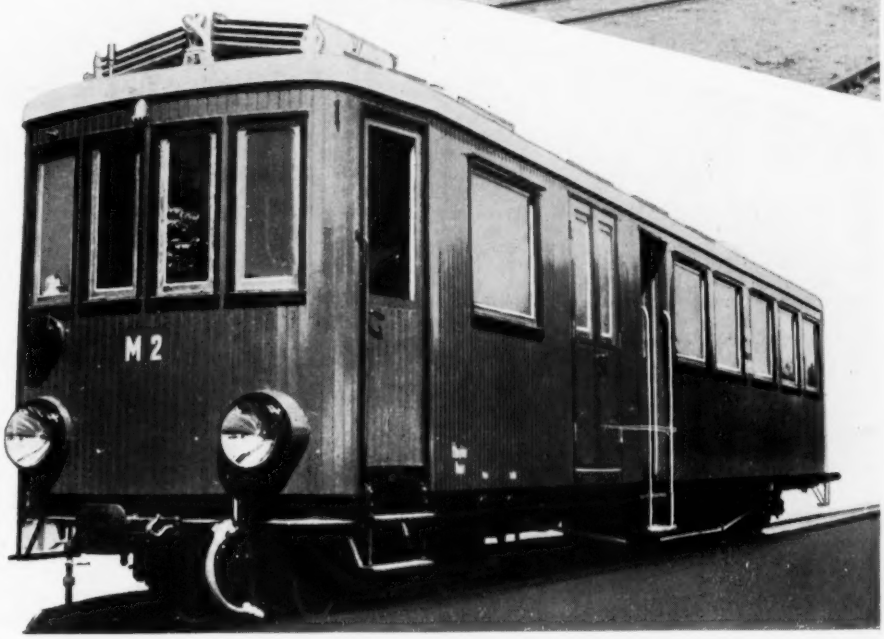
The compression of the engine into the smallest possible space thus introduces conditions which in many respects are detrimental to a low oil consumption. The state of affairs is easy to visualise by considering the crank and connecting rod threshing around at high speed, in a confined space drenched with oil which has unrestricted access to the cylinders, the scraper rings providing the only effective barrier to the oil reaching the combustion chamber. This is one reason why the economy obtainable in high-speed engines is lower than in the case of units designed for industrial purposes, running at constant speed and moderate revolutions.

DIESEL SPEED RECORD IN GERMANY.—Reports have just reached us that a speed of 200 km. p.h. (124 m.p.h.) has been touched by a diesel set on the Berlin–Hamburg line between Ludwigslust and Wittenberge. This is probably one of the new three-car 1,200 b.h.p. sets.

INAUGURATION OF DIESEL TRACTION IN ESTONIA

DURING 1935 the Estonian State Railways began their first diesel-operated services with one broad-gauge (5 ft.) and two narrow-gauge (750 mm. or 2 ft. 5½ in.) railcars, both of which were built by Frichs of Aarhus. The broad-gauge vehicle is working over the 63-mile Tallinn-Haapsalu line, and carries 88 passengers in two saloons. The bogies have 41½-in. wheels spread over a base of 8 ft. 3 in.; and are pitched at 46 ft. 5 in. centres. Lavatory and luggage accommodation is provided. Power is supplied by a six-cylinder Frichs engine developing a continuous output of 220 b.h.p. at 1,000 r.p.m. and this is coupled direct to a d.c. generator which supplies current to nose-suspended traction motors. The radiators are of the gilled-tube type, and are located on the roof.

Top right: The new 220/240 b.h.p. diesel-electric railcar built by Frichs for the broad-gauge lines of the Estonian State Railways



Right: One of the two Frichs cars for the 750 mm. gauge lines in Estonia

The two narrow-gauge vehicles operate on the Tallinn-Viljandi line, 94 miles long. The general layout of the car and the seating accommodation are shown in the diagram at the foot of this page. Electric transmission is fitted to these cars also, but in this case the Frichs engine has a continuous capacity of 115 b.h.p. at 1,200 r.p.m., the unit weight being about 17 lb. per b.h.p.

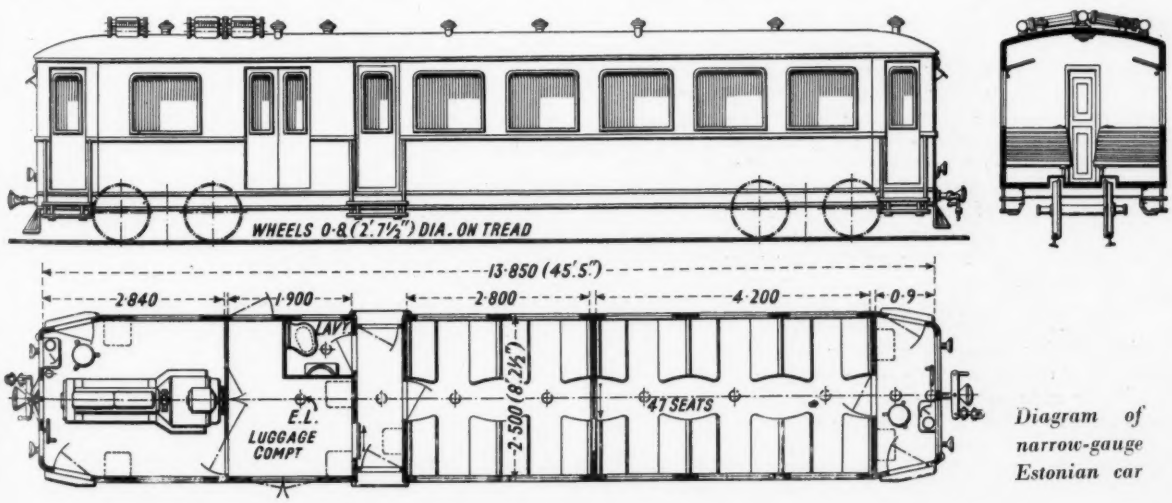


Diagram of narrow-gauge Estonian car

AN ELECTRICAL ENGINEER ON DIESEL TRACTION

IN a paper entitled "Diesel-Electric Railcars and Locomotives" read before the American Institute of Electrical Engineers, Mr. N. W. Storer, of the Westinghouse Electric & Manufacturing Co., made some pertinent remarks on the problems associated with diesel traction, and on the electrical equipment of diesel-electric vehicles, which, for American conditions, he considered to be superior to units embodying other forms of transmission. An abstract of some of his observations is given below.

Problems of Diesel Traction

The main problems connected with the use of diesel engines for heavy railroad work may be divided into four main categories, as follow:—

The Engine.—The engines must be developed in large enough units, of small enough dimensions, light enough, reliable and satisfactory in every way so that the locomotives driven by them will have advantages that will outweigh the increased cost over steam locomotives. The question of engine design is a very large subject in itself, and is being ably handled by engine builders.

The Drive.—The perfect engine may be designed and built, but it is of little use in a locomotive without a satisfactory means of transmitting the engine torque to the driving wheels. The electric drive with a generator driven by the engine furnishing current with variable voltage to electric motors geared to the drivers, is generally accepted as the best system that can be devised, but some engineers see in it a round-about and inefficient way of getting the power to the wheels. They yearn for what seems to be a more simple means, such as some unknown mechanical drive.

Control.—The engine may be perfect, and the generator and motors 100 per cent. good, but the locomotive will not be up to its possibilities until it is equipped with a control system that will not only be perfectly smooth in its application of power to the locomotive, but will whenever it is needed utilise every bit of power the engine can develop without overloading it.

Auxiliaries.—There are many auxiliaries on a locomotive that are of vital importance in the performance of the locomotive, many of which require power for various purposes: engine starting, air compressors for the brakes, blowers or fans for cooling radiators for engine oil and water, blowers for cooling motors on large locomotives, and pumps for oil and water. Power for all these purposes should be furnished by the engine, which is the sole source of power. Passenger locomotives will probably also have a boiler for train heating which may, as in the case of the one on the Canadian National Railroad, be equipped with an economiser to save the heat in the waste gases from the engine.

The introduction of diesel traction on steam railroads will bring no quarrel between the straight electric and the diesel-electric locomotive. Each will be applied in the place where it is most economical. A straight electric locomotive can be equipped with exactly the same traction motors as a diesel-electric locomotive, and will have the same maximum tractive effort and the same maximum speed as the diesel-electric. The difference between the two is that as the maximum voltage is available in the contact wire at all tractive efforts, the power output at maximum tractive effort of the straight electric can be 3 to 3½ times greater than that of the oil-engined unit, or the maximum tractive effort which begins to drop off at 3 to 5 m.p.h. in the oil-electric, is sustained to 15 or 20 m.p.h. with the straight electric.

Motor Capacity

The question naturally arises as to why it is necessary to equip a diesel-electric locomotive with traction motors which are able to carry, even for a short time, a load three to four times as great as the oil engine output. The current capacity of the motors is fixed by the tractive effort required; the voltage is determined by the maximum speed required with full engine output. These two conditions, together with the range of speed over which the continuous load is required, are the determining factors in the size of the motors. Of course, the high voltage and the high currents are never applied simultaneously on the diesel-electric locomotive as they are with the trolley-fed motors, but the weight of material is nearly as much as if they were to be so applied.

It is further desirable to have larger motors than are necessary to handle simply the engine output at one speed. The motors, in order to utilise the full output of the engine over a range of locomotive speed from the minimum to the maximum, should be large enough to carry this load continuously over a considerable portion of the speed range. For that reason it is customary with the diesel-electric locomotive to rate the motors at a voltage considerably below the maximum which they receive from the generator. For instance, in the locomotive of the Canadian National Railways equipped with a 1,330 b.h.p. engine, the motors can carry the full tractive effort obtainable at 10 m.p.h. at their one-hour rating. They will operate continuously from 17·5 m.p.h. up to 50 m.p.h. with all the power the engine can give them. The increase in speed from 17·5 up to 26 m.p.h. is obtained by increasing the voltage of the generator. From 26 m.p.h. up to 50, the motors are operated at constant voltage but with weakened fields, there being several steps in shunting the fields.

With diesel-electric, where the power is limited to practically the rating of the engine, it is essential that the motors as well as the generator be of maximum efficiency so as to transmit the maximum percentage of power to the wheels. The size of copper in the windings of these motors and generators is of special importance when it comes to heavy loads. Since the copper loss increases as the square of the current, while the power input to the generator remains constant, the copper loss in percentage also increases as the square of the current.

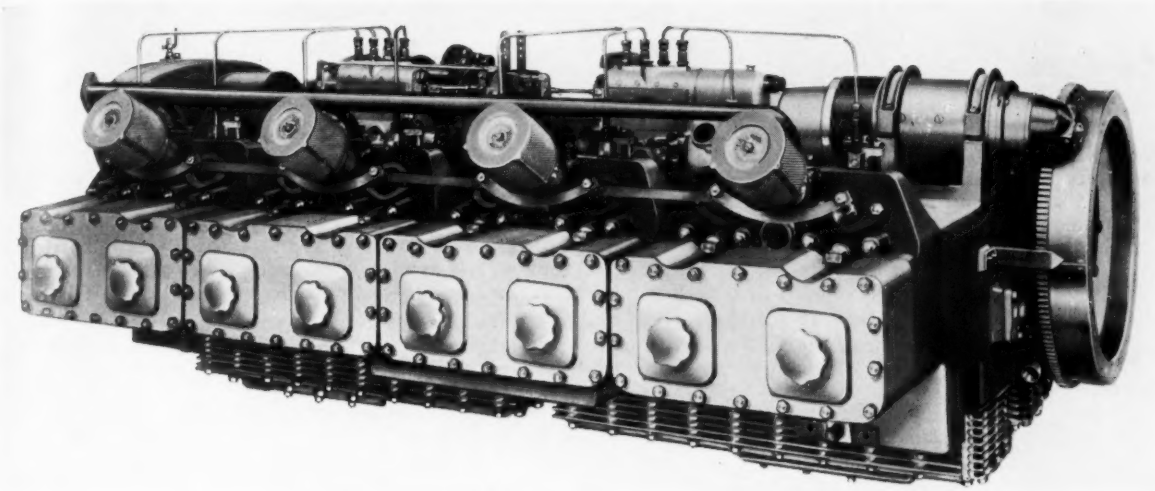
Main Generator

The generator for a diesel-electric equipment is materially larger than one which would be used for the same engine located in a power-house delivering current to a constant voltage network. The power-house generator, for instance, would have as its maximum current the amount necessary to give the output with the engine delivering its rated load and with a normal line voltage. The continuous rating would scarcely be more than 85 per cent. of this maximum, so that the rating of a generator in horsepower would not be more than 80 per cent. of the engine rating.

The generator for the locomotive, on the contrary, would be materially larger, as it must be able to load the engine to its full rating over a considerable range of voltage, besides carrying very heavy loads at starting. The generator, in fact, must be able to carry the current required for the traction motors, which, as has been shown, are necessarily large for the engine capacity. Series-parallel control will make a material reduction in the generator capacity in a class of service such as switching, or on railcars making frequent stops. Otherwise the generator must be able to carry the same currents that are supplied to the motor circuits. In conclusion, it may be said there is a great field for diesel traction, which, in America, will be given a fillip when engines of 2,000 to 3,000 b.h.p. in a single unit can be made.

A NEW HORIZONTAL ENGINE

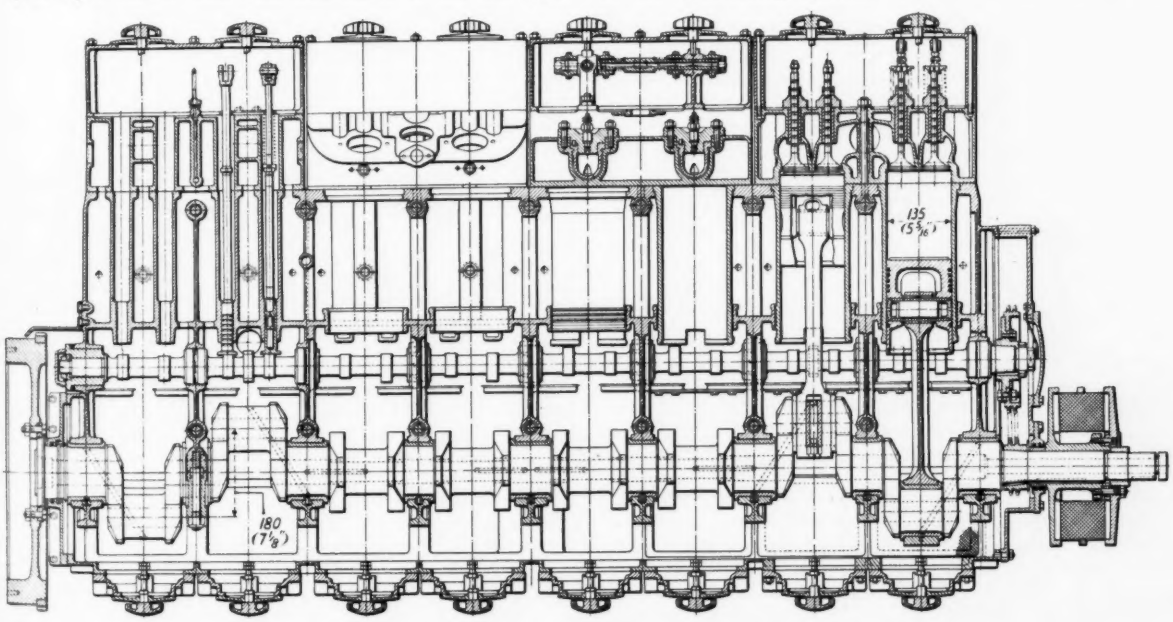
Medium-weight design with air-cell combustion chamber has fuel consumption of 0·48 lb. per b.h.p. hour at full load and 0·44 lb. at three-quarter load



185 b.h.p. horizontal engine with all eight cylinders on one side of the crankshaft

A FOUR-STROKE horizontal engine of unusual design has been developed by the Vomag A.G., of Plauen, and is to be given a trial on railcars in Germany. Its feature is that all eight cylinders are on one side of the crankshaft. The cylinders are 135 mm. by 180 mm. (5·33 in. by 7·1 in.); the engine runs at 1,500 r.p.m. and develops 185 b.h.p. continuously and 200 b.h.p. as a working maximum. On the continuous rating the weight is equivalent to 22 lb. per b.h.p.

The cylinder block and crankcase are in a single casting of light metal, with cast iron liners of the wet type. The cylinder heads are cast two and two together, and contain a hemispherical turbulence chamber, and single inlet and exhaust valves of very large size. The crankshaft is hollow-bored throughout; it is supported on nine plain bearings and is fitted with a rubber vibration damper at the end opposite to the flywheel, where the timing gears are situated. The Bosch fuel pump is in two four-ram sections, and together with the starting motor, lighting dynamos, and air filters, is located on top of the engine. Two gear-driven pumps maintain the pressure in the lubricating system.



Cross-section of Vomag eight-cylinder horizontal oil engine

TRANSMISSIONS FOR DIESEL LOCOMOTIVES AND RAILCARS

The Ardelt gear transmission

By STUART MIALL, B.Sc.

ONE disadvantage of most gearboxes is their failure to provide for the maintenance of the tractive effort during gear changes. Between the disengagement of one gear and the engagement of another there is a definite break in the connection between engine and driving wheels, and the interruption of the drive occupies a longer period than this, for the pulling of the engine must be abated before the first gear can be disengaged and it cannot be resumed until after the second has been engaged.

With a four-speed box there are three interruptions in the drive during the acceleration period so that this period is appreciably longer than it would be were an

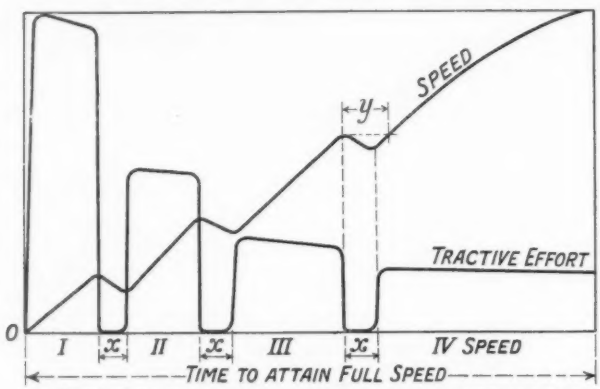


FIG. 1. SPEED INCREASE WITH ORDINARY GEARBOX

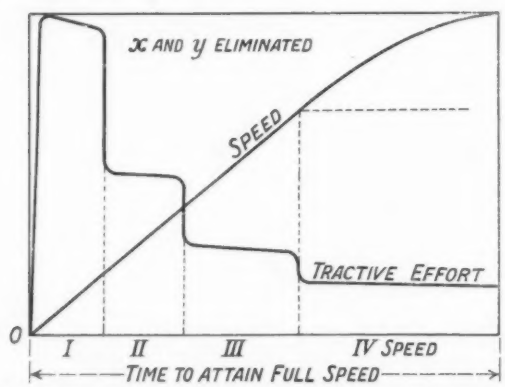


FIG. 2. SPEED INCREASE WITH ARDELT GEARBOX

instantaneous change of gear made possible. Besides necessitating the attainment of higher maximum speeds with a stopping train or railcar in order to maintain a given schedule, the breaks in the drive give rise to a certain amount of discomfort to passengers and may, with a train, lead to broken couplings.

The Ardelt gear, which originated in Germany, is one of the few mechanical transmissions which afford a sustained drive in place of an interrupted one. The advantages of the former over the latter will be appreciated when Fig. 2, relating to sustained drive is compared with Fig. 1, relating to interrupted drive. The change from third speed to fourth or top speed is seen in Fig. 1 to introduce a time period of *y* during which the speed falls slightly and then recovers its former maximum, preparatory to a further increase. The earlier gear changes introduce similar hesitations in the speed-time curve, so that the base line of this curve is on the whole longer in Fig. 1 than in Fig. 2, the addition being the sum of the three periods of which *y* is the last.

Fig. 3 shows diagrammatically the connection between a driven wheel *i* in the Ardelt gearbox and the driving shaft *a*. It is in this method of coupling or connection that the Ardelt gearbox differs from others, and to this the advantages of the Ardelt gearbox are attributable. Wheel *i* geared in some manner directly to the driving wheels, is carried by anti-friction bearings on shaft *a* and normally is free thereon. Shaft *a* is rotated by the engine, and the drive is effected by making wheel *i* integral with *a* through the agency of a multiple-plate friction clutch. The

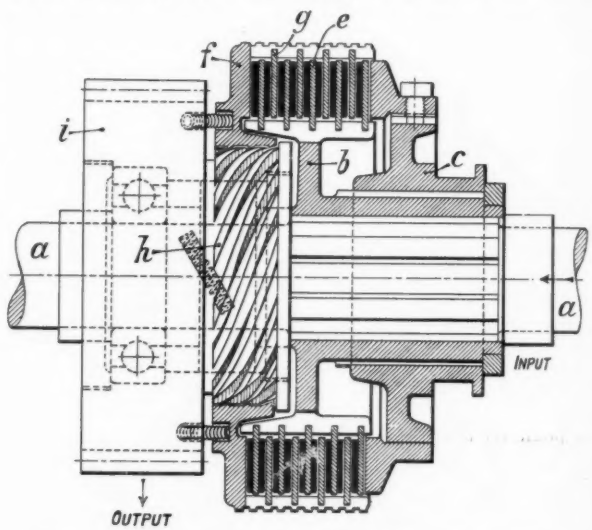


Fig. 3—Diagrammatic section through Ardelt friction coupling

plates *e* of this clutch turn with member *b* and hence with shaft *a* to which *b* is splined. Plates *g* of the clutch turn with member *f*, which is carried on a multiple threaded extension of wheel *i*. Between members *c* and *b* there is a feather connection, and wheel *i* is locked to shaft *a* by pressing *c* to the left. With *a* at rest, pressing *c* to the left would merely squeeze the plates of the clutch together and force *f* to move spirally to the left on the screwed extension of *i*.

Its direction of rotation would be counter-clockwise viewed from the right, and would therefore be against the inclined spiral springs normally urging it clockwise and to the right. With shaft *a* rotating clockwise the act of pressing *c* to the left is still effective in forcing *f* to the left, but now, due to friction between the clutch plates, *f* must be forced against a tendency to the right promoted not only by the inclined springs but also by the clockwise

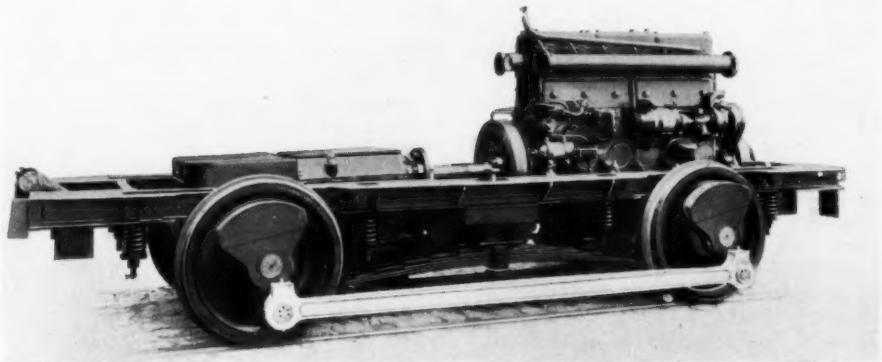


Fig. 4—Arrangement of 225 b.h.p. M.A.N. engine and Ardelt gearbox on the bogie of a standard-gauge railcar belonging to the Niederbarnimer Railway (or Heidekrautbahn), near Berlin

drag on plates *g* of the clutch. This clockwise drag on *f* becomes greater and greater as *c* is pushed further and further to the left, and as the inclined springs are more and more compressed. This same drag is transmitted to wheel *i* via its screwed extension, and ultimately it becomes sufficient to enable wheel *i* to overcome the resistance comprising the load. Once it begins to rotate, wheel *i* will gather speed and eventually it will turn with shaft *a*, when all clutch slip will cease.

If now the driven vehicle runs on to a down grade so steep that wheel *i* tries to over-run shaft *a*, member *f*, turning with shaft *a* in consequence of the clutch, will also be over-run, and the screwed extension of wheel *i*, turning clockwise in relation to *f*, will draw *f* to the left. If member *c* does not follow this motion up the clutch will disengage and so permit unlimited rotation of wheel *i* at speeds above that of shaft *a*.

Thus the Ardelt clutch gives a free-wheel action and this, besides being useful in itself, enables the drive to be taken up without a pause by any higher gear ratio (the larger wheel for which will also be on shaft *a*), when the clutch for this is operated. There is no need to declutch wheel *i* before a parallel drive is engaged to give a higher speed, nor is there any danger in engaging a parallel drive giving a lower speed, as the wheel for this lower gear will merely overtake shaft *a* and go on doing this until the higher gear is unclutched, when its speed will fall and become equal to that of shaft *a*. At this point its fall in speed will be arrested, for the lower gear will then take up the drive.

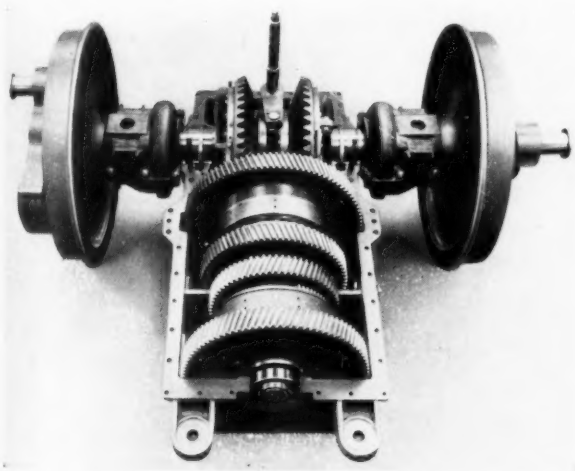


Fig. 5—Ardelt gearbox of 225 b.h.p. with top cover removed

Fig. 3 shows a clutch for mechanical actuation, but clutches have been made for pneumatic, hydraulic and magnetic operation. In the magnetic clutch, *c* is pulled to the left against springs by an electro-magnet inside *b*, which is supplied with current through slip rings on a member keyed to the right of *c* on shaft *a*. Plainly the control of the Ardelt gearbox can be made very simple, and the multiple operation of several boxes by remote control presents no difficulties.

Fig. 4 shows a transmission unit of 225 b.h.p. as it appears mounted with an M.A.N. engine on the bogie of a railcar on the Niederbarnimer Railway, which has been running in regular service for five months. Units have been constructed for road motors and for cranes, where the facility this type of gear gives for changing the speed of lift without arresting the upward motion of the load is a particularly valuable feature.

Bigger and Brighter Zephyrs

THE two four-car 600 b.h.p. Twin Zephyrs running on the Burlington route between Chicago and the Twin Cities are to be transferred to other routes about the end of this year, and replaced by two seven-car twin-engined stainless steel trains now being built by the E. G. Budd Manufacturing Corporation. These new trains will be 10 ft. wide, against the 9 ft. 1 in. of the present trains, and will have accommodation for 200 passengers, compared with the 72 of the present three-car trains. The make-up will include a dining car, a cocktail lounge, a parlour car, and an observation car.

The Chicago Burlington & Quincy Railroad has ordered two twin-engined trains built on the lines of the four stainless steel Zephyr trains now in service. Construction is being pushed forward by the E. G. Budd Manufacturing Company in an endeavour to effect delivery during the course of the present summer. It is intended to put these trains into service between Chicago and Denver, via Omaha, on a route with a mileage of 1,039, which will be covered in approximately 16 hr., or at an average of 65 m.p.h. including six or seven stops. There will be ten cars, including a power-baggage car at each end and four sleeping cars, with accommodation for about 200 persons.

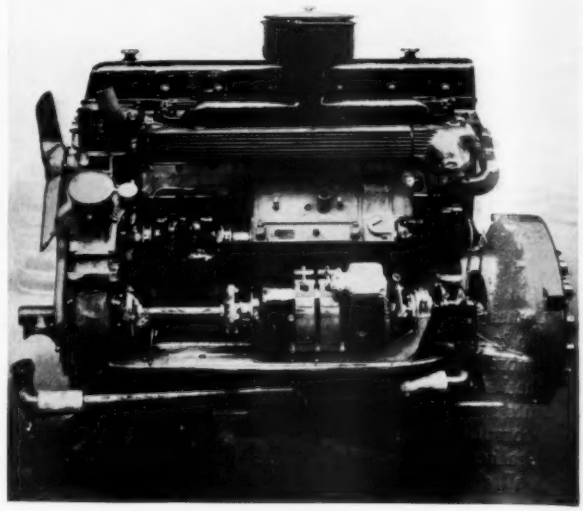
BOLINDER DIESEL LOCOMOTIVE.—The Swedish State Railways have acquired a small oil-electric shunting locomotive powered by a 150 b.h.p. Bolinder two-stroke crankcase-scavenging diesel engine running at 1,200 r.p.m. Asea electric transmission is used and incorporates a 97 kW. low-voltage (480 maximum) direct-coupled generator.

RAILCARS FOR THE MOGYANA RAILWAY

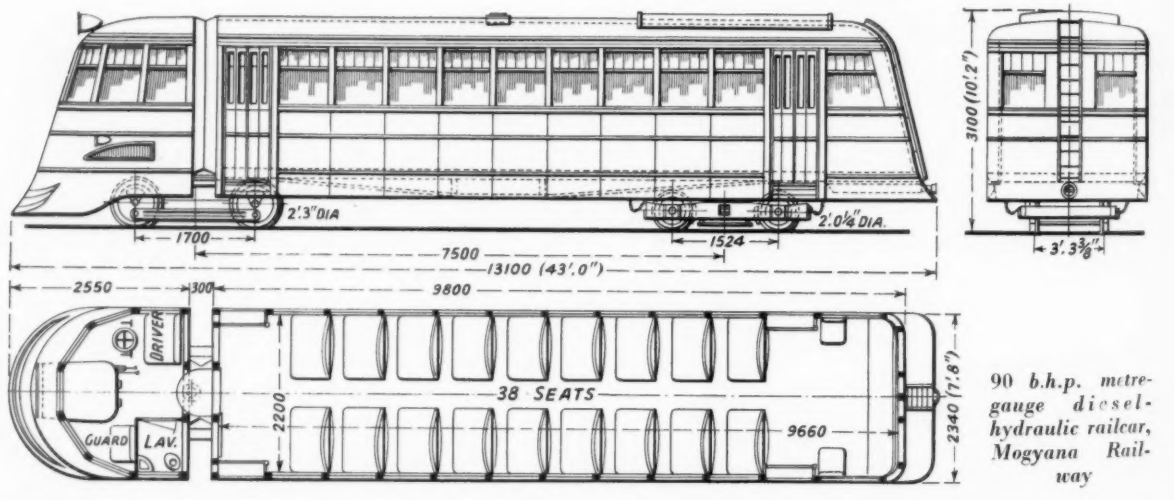
THE decision of the Mogyana Railway to acquire two metre-gauge diesel railcars was recorded in the issue of this Supplement for September 6, 1935, and the vehicles are now well on the way to completion. The bodies, underframes, and bogie are being built in the railway's own shops, and the power units and transmissions are being supplied by Leyland Motors Limited.

As may be seen from the accompanying drawing a form of articulation similar to that used with success on the Great Northern Railway of Ireland and the County Donegal Railways has been adopted. The front bogie supports the engine, transmission, and the driving cab, and the body is supported by a pivot at the rear of the bogie. Fixed leather-covered seats to the number of 38 are to be provided, but further temporary seats can be fitted up at the rear and down the centre passage and in the luggage space. Vacuum and hand brakes are being fitted, and couplers at the rear end will enable a goods wagon or light trailer to be hauled. Electric lighting of Leyland make is to be installed.

A Leyland 8·6-litre six-cylinder oil engine developing 90 b.h.p. at 1,800 r.p.m. forms the power unit and drives a set of Leyland (Lysholm-Smith) hydraulic transmission. The engine is practically identical with the engine used by Leyland for road transport, and is fitted with a CAV-Bosch fuel pump. The proportions of the engine and transmission are suitable for a top speed of 70 km.p.h. (43·5 m.p.h.) being developed on the level. The cars are expected to weigh 17 tons when fully laden, of which 11 to 12 tons will be on the leading bogie. They are intended for use between Ribeirao Preto, Sao Simao, Pontal, and Sao Joaquim.



90 b.h.p. Leyland engine of the type being installed in the Mogyana railcars



90 b.h.p. metre-gauge diesel-hydraulic railcar, Mogyana Railway

MR. HAROLD SINCLAIR.—The Council of the Institution of Mechanical Engineers has awarded a Thomas Lowe Gray prize to Mr. Harold Sinclair for his paper "Recent Developments in Hydraulic Couplings," which was abstracted in the issue of this Supplement for May 17, 1935.

MAGNESIUM ALLOYS.—For the production in this country of Elektron, the well-known magnesium alloy, a works is being erected at Clifton, Manchester, by Magnesium Elektron Limited, an associated company of F. Hughes & Co. Ltd. Part of this new factory will occupy a portion of the old Clifton power station of the L.M.S.R., which supplied current to the Manchester-Bury electrified line until the supply was changed over to the grid. Elektron, which has a specific gravity of 1·81 to 1·83, has been used to an appreciable extent in high-speed diesel engines for such parts as crankcases, valve gear casings, induction pipes. Some of the A.E.C. oil engines were fitted with Elektron crankcases some years ago.

SMALL DIESELS FOR MEXICO.—The Drewry Car Co. Ltd. has received repeat orders from the Eagle Oil & Shipping Co. Ltd. for two 0-4-0 and two 0-6-0 shunting locomotives fitted with Gardner engines, for service in Mexico. These diesel locomotives are duplicate with those previously supplied to the same company. (See issue of this Supplement for May 17, 1935.)

Railcars for Western Australia

Sir W. G. Armstrong Whitworth & Co. (Engineers) Ltd. has received an order for six diesel-electric railcars for the 3 ft. 6 in. gauge lines of the Western Australian Government Railways. The cars will be powered by 140 b.h.p. Armstrong-Saurer engines fitted with A.B.E. electric transmission. One car will be shipped in a complete condition, but the bodies of the remaining five will be dismantled for re-erection in Australia. One spare engine-generator set is included in the order. The railway is building in its own shops some special trailers.

Egyptian Diesel Services

Since being delivered in September last, the Ganz diesel railcars have given generally satisfactory performance. On October 11 a fast service over the Cairo-Suez direct line was begun. There are two trains a day in each direction, leaving Cairo (Pont Limoun) at 7.55 and 18.50, and leaving Suez at 7.31 and 19.31. The times for the down journeys are 122 and 120 min. respectively, and for both the up journeys, 129 min., the distance being 80 miles, and the maximum grade 1 in 100. First and second class passengers only are carried on these services.

On December 1 a supplementary suburban service with diesel cars was started on the Helwan line. Seven return trips a day are operated between Cairo (Bab-El-Louk) and Helwan, 15½ miles, to a schedule of 28 min. including three stops. Originally, first and second class passengers were carried, but the congestion was so great owing to third class passengers being willing to pay the difference in fares to get away from the steam trains, and through ordinary first and second class passengers making a point of travelling by the diesel service, that from December 5 the use of the car has been confined to first class passengers only.

A further diesel service with first and third class accommodation was begun on January 1 between Alexandria and El Hammam. This is a slow stopping service, which takes 2 hr. 35 min. to cover the 52 miles. The successful performance on these three services bears out in a striking manner the remarks about the possibilities of such cars which we made in an editorial in the issue of this Supplement for September 6, 1935.

Publications Received

Diesel Engines. By J. W. Anderson. London : McGraw-Hill Publishing Co. Ltd., Aldwych House, W.C.2. New York : McGraw-Hill Book Company, Inc. 9 in. by 6 in. 485 pp. Price 30s. net.—Perhaps more than any other book on the diesel, this work can lay claim to be of interest to the student, the designer, the builder, the operator, the scrapper, and the general reader. It does not go beyond the depth of the average intellect, yet is not so elementary as to suit no one but first-year night-class students. It is obvious that the author has paid little attention to cultivating style in his writing, but the plain, straightforward, and concise language he uses has moulded itself into a style which is convincing without being displeasing. A gentle introduction is followed by equally quiet chapters on history, theory, and descriptions of the different types of engines, so that when the reader reaches the solid technical stuff his brain is firing regularly after a cold start—and he is a third of the way through the book. The fact that the author keeps to American practice, although including European designs such as those of Beardmore and Sulzer which are built under licence in the U.S.A., enhances the value of the book, for it makes for concentration. The descriptive section includes a short chapter on railway engines, and the details of this type are not altogether overlooked in the technical chapters. But the worth of the book in comparison with the usual run of publications on the diesel is the amount of space given to the governing and control mechanisms, lubricating and fuel systems, cooling, starting methods, and the utilisation of the heat in the exhaust. Final chapters on performance and the selection of an engine are the only ones which suffer by reason of their brevity. Special commendation is due to the publishers for the high-class way in which they have produced the book, but nevertheless, judging by present-day standards, the work is too costly, and the price might be reduced with benefit alike to publishers, author, and prospective reader.

High Speed Diesel Engines. (Second Edition.) By Arthur W. Judge, Wh. Sch. London : Chapman & Hall Limited, 11, Henrietta Street, W.C.2. 8½ in. by 5¾ in. 347 pp. Illustrated. Price 15s. 0d. net.—Although this work, which is stated to be an elementary text book for engineers, students, and operators, is often "confidently recommended" and given that convenient appellation "a standard textbook," it is impossible to place it on the same level as the work reviewed immediately above. Essentially it is a book by the professional writer rather than by the competent engineer. It may be objected that as the price is but half, there is nothing to cavil at in the lower standard, but in these days of light purses no one desires to lay out 180 copper coins to receive a book which is well over 50 per cent. descriptive. Any engineer, student, or operator with a three-shilling book of stamps, a couple of dozen envelopes, and a moist tongue, could obtain most of the material in this more than half of the book by polite requests to makers for a copy of their catalogue and current brochures. Moreover, the supplicant for free literature would obtain more up-to-date information, for all the illustrations and explanatory matter in Mr. Judge's book do not represent the latest practice, and many of the line drawings are on too small a scale, and have the text packed too closely round them. It is a great pity that these defects should be present in a book of such size on a subject which is by no means swamped with literature, particularly in view of the fact that tucked away in this mass of catalogue matter is some really good material, such as the chapter on actual conditions in high-speed engines. The section on engines for railway traction is a most curious compilation, and seems to be concerned mainly with (*a*) engines which have not been used in railway work ; (*b*) engines which have been unsuccessful in railway work ; and (*c*) engines which are used for railway work only in powers of under 100 b.h.p. Alas, that Maybach (with 300 engines in service) is but a name in a table. But doubtless the Friedrichshafen firm will find comfort in the knowledge that the names of Frichs and Renault (with a combined total of 300 engines to their credit) do not appear at all. But Mr. Judge, or rather, a contemporary of ours (since Mr. Judge quotes it) is ahead of us in some respects. We have not yet received particulars of the two three-car diesel trains of 400 B.H. (*sic*) which are stated to be running between Paris and Mentone, and, strangely enough, the P.L.M. Railway does not seem to have heard of them either.

Stationary Diesels.—The Willans works at Rugby, belonging to the English Electric Co. Ltd., are now mainly concerned with the production of diesel engines for railway traction and stationary purposes, the latter predominating so far as total output is concerned. The heavy models are suitable for generating stations, pipe lines, etc., and are also used in the plant of the B.B.C. at Droitwich. These English Electric four-stroke engines are made in sizes from 150 to 1,000 b.h.p. and are described in a brochure recently published by the maker.

NEW DEUTZ ENGINE FOR BIG RAILCARS

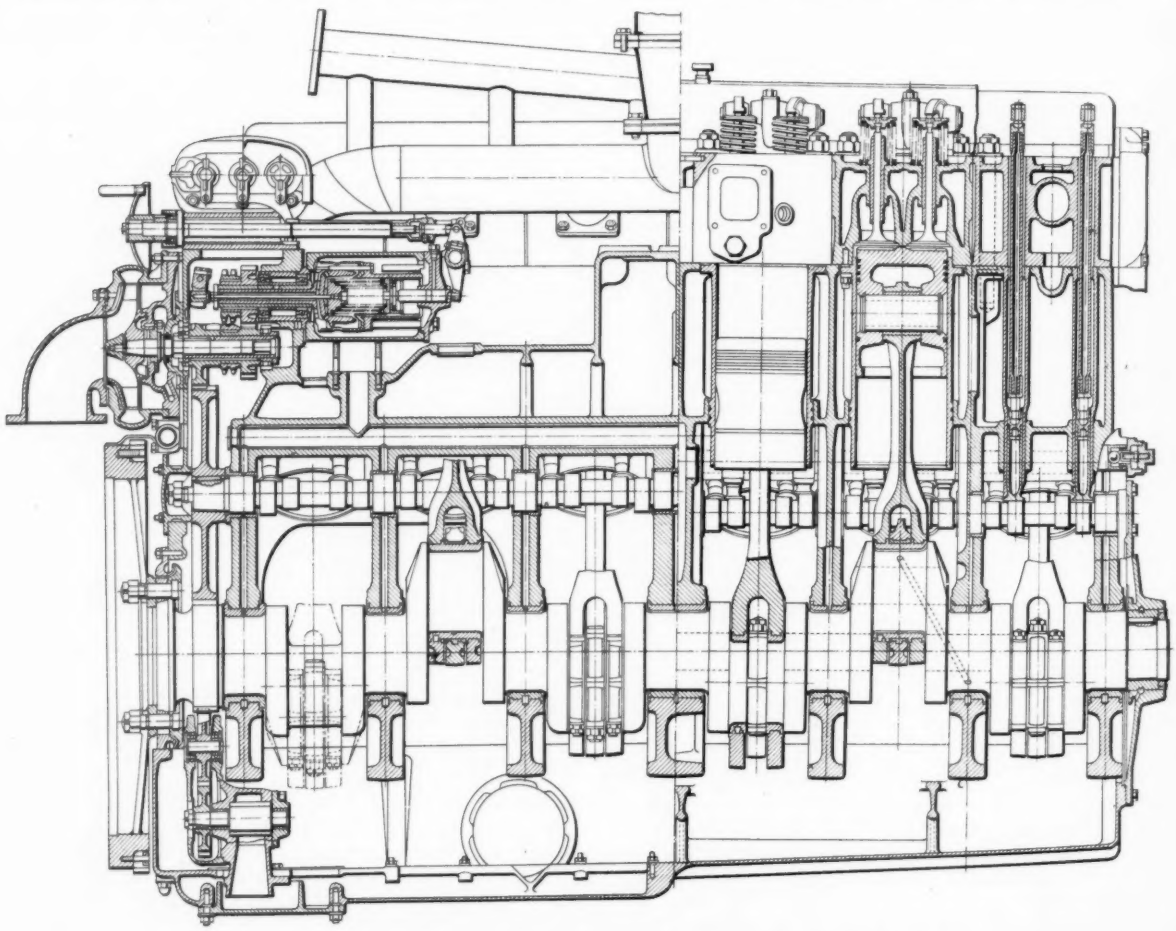
A three-point suspension system on the bogie is to be used by the Reichsbahn for these four-stroke V engines

A GOOD deal of attention has been given in Germany to the production of engines within the range of 300-600 b.h.p. for installation in double-bogie railcars and in each end of streamlined trains. The latest engine of this type has been designed by the Deutz Motoren-Gesellschaft, of Cologne, and following normal German practice it is intended primarily for bogie mounting, although suitable for installation on the main underframe.

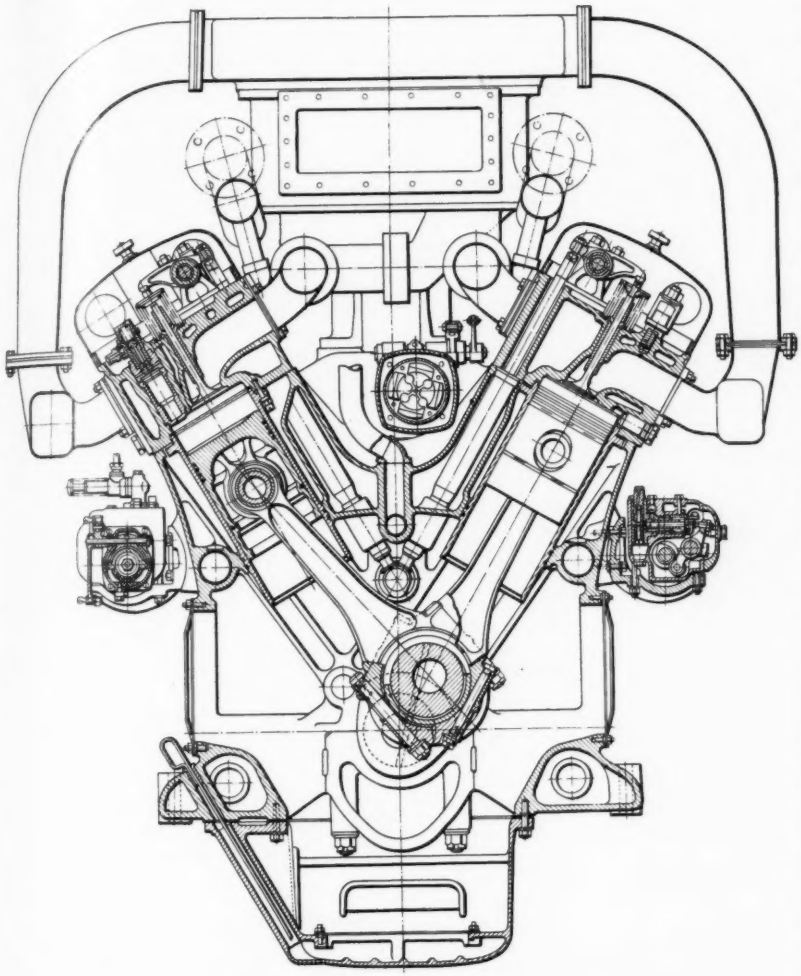
In 12 cylinders 150 mm. by 200 mm. (5·9 in. by 7·9 in.) arranged in two banks with an angle of 60 deg. between them, the engine develops a continuous output of 360 b.h.p. at 1,400 r.p.m. on a weight of 15·3 lb. per b.h.p. At the moment, the Reichsbahn is intending to use the engine without supercharging, but extensive trials have been made with Büchi supercharging equipment and a rated output of 500 b.h.p. at the same rotational speed is possible. The drawing on the opposite page shows the engine fitted with a Büchi supercharger.

The crankcase and cylinder block are cast in one piece, of light-metal alloy, with cast-on seats for the fuel pump and filter, lubricating oil filter, cooling water pump, and certain other auxiliaries. The stresses arising from the gas pressure are transmitted through double T members to the bolts securing the cylinder heads to the cylinder block. The cylinder heads contain the usual Deutz precombustion chamber and are cast individually. The cylinder liners are centred in the heads and secured by special studs; this construction eliminates any difficulties of making a common joint between the combustion space and the water jacket. During erection, or after repair, the cylinder head and liner are inserted in the cylinder block as a single unit. At the lower end the liner is guided in the usual way and the water seal is effected by two heat-resisting rubber rings. Each bank of cylinder heads is covered by a single casing of light metal, which has between each cylinder head a cross partition with felt packing strips.

A single casehardened camshaft is located in the top of the crankcase and is driven by a train of spiral gears from the flywheel end of the crankshaft. The rocker arms are operated by tubular push rods of hydronalium. One inlet and one exhaust valve per cylinder are provided; they



Longitudinal section through 360 b.h.p. 12-cylinder Deutz railcar engine



Cross section of 360 b.h.p. Deutz four-stroke engine

are of heat resisting steel, and the stems run in guides of a special grey cast iron. Positive closing is effected by double helical springs. The fuel injection valve is screwed into the precombustion chamber and can be removed very easily. A 1·7-volt heating plug is fitted in each precombustion chamber.

Balance weights of dovetail form are secured to the webs of the chrome-molybdenum steel crankshaft, but these are not shown in the drawings. Some reduction in the centrifugal force and in the size of the balance weight has been obtained by the eccentric hollow-boring of the crankpins, a feature which, so far as is known, has not been embodied previously in rail traction engines. The main bearing and crankpin journals are hardened on the Doppelduro system in which the outer zone forms a high surface resistance material round a tough centre core. Seven lead-bronze bearings support the crankshaft, and all except that nearest the flywheel have ample end clearance. The flywheel-end bearing is fitted between the last crankweb and a collar on the shaft in order to take up the end thrust. The bottom caps of the bearings are cast of light metal, and are of a section giving great stiffness.

Each pair of opposite cylinders works on a common crankpin, the rod from one cylinder having a big end which is forked over that from the opposite cylinder. The bearing has three concentric rings, two of which are common to the three connecting rod feet. The inner ring is a lead-bronze lining running on the crankpin; the intermediate ring is a steel shell with external collars fixing the positions of the two connecting rods. The forked rod is keyed to this steel shell, but the plain rod runs on a bushing of lead bronze on the circumference of the shell. Both the rods and their caps are die stampings.

Floating gudgeon pins are used for the connection of the rods to their pistons. These pins are hollow bored to approximately 0·75 of their diameter. The pistons are of aluminium alloy and carry three pressure and two scraper rings. The latter are arranged one above and one below the gudgeon pin. A slightly hollowed form of piston crown has been adopted, but at the side farthest from the injection nozzle the dishing is brought up to the level of the rim in order to prevent the fuel jet striking the vertical wall of the cylinder head.

Two six-ram Deutz pumps supply the fuel to the injection valves. Each pump is located outside the cylinder bank which it feeds, and is chain driven by the arrangement shown on the last of the accompanying drawings. There is an additional pump, of the Bosch type, which supplies the injection pumps with fuel from the service tank, and a horizontal hand-operated air pump removes the air from the pipe lines before the engine is started up. A very sensitive form of centrifugal governor controls both the fuel injection pumps; it is mounted on the left-hand pump looking from the flywheel end, but is not shown on the drawings reproduced. The fuel is passed through a Bosch reversible filter which can be cleaned while the engine is running.

The air supply for the engine is to be drawn in through the side of the railcar. From the side panel it will be led through a large pipe to a filter located above the cooling-water pump at the flywheel end, whence it will be taken separately to each cylinder bank. Special filtering cartridges are incorporated and can be withdrawn easily when the filter covers are removed. The exhaust is brought out into two manifolds located in the space between the cylinder banks; these manifolds are lagged with asbestos and are connected to the silencer at the non-driving end of the engine.

Combined force and splash lubrication is used, and about 80 litres (17½ gal.) of oil is contained in a light-metal sump studded to the bottom of the crankcase. A gauze cover is fitted just above the oil level. A pump, driven by spiral gears from the crankshaft, draws oil from the sump, and to prevent trouble in cold weather, when the oil is stiff, it has a relief valve opening to the sump at a pressure of 10 atm. (142 lb. per sq. in.). The flow is from the pump through an Auto-Klean strainer, through the cooler to the main distribution pipe which is cast in the crankcase. If, on starting, the oil is too stiff to flow through the cooler, it is bye-passed to the distribution system. From the main distributor pipe perpendicular oil holes lead to the main bearings of the crankshaft and also connect with the camshaft bearings. The oil goes first to the camshaft bearings where some of

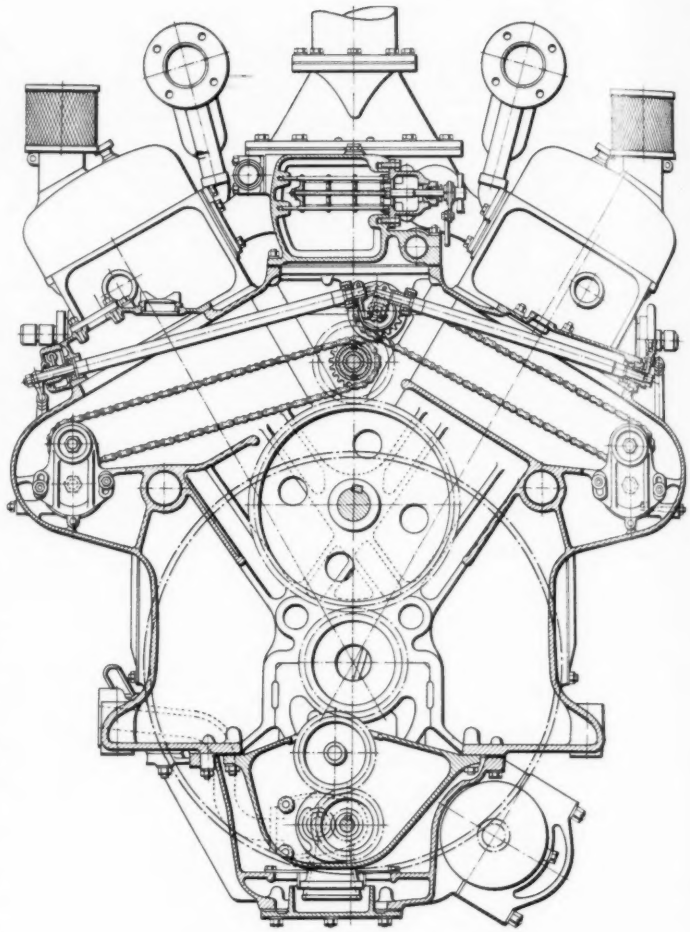
it is used, and the remainder passes through grooves and on to the crankshaft bearings, where specially arranged grooves ensure good distribution.

Oil flows from the main bearings to the big-ends through oblique pipes expanded in the crankshaft, and the position of these pipes where they come through the crankpin is so arranged that the lubricating point is a few degrees in advance of the point of maximum pressure. Splash from the sides of the bearings lubricates the liners and gudgeon pins. Throw-off grooves turned in the crank webs help to prevent the over-lubrication of the liners. The oil level in the sump can be checked at any time by a dip-stick, but seatings are provided for the attachment of an electrical indicator for the oil level if desired. Oil can be added to the sump either by a filling pipe from the engine room or by means of a hand pump. Oil drip (fuel and lubricating) from the tappets and rockers collecting on the heads is led by the form of the heads to the lowest point, where a ball connection is effected with a drain pipe serving all the cylinder heads of one bank.

The oil cooling equipment consists of a closed pipe circuit of spiral copper tubes mounted between flow and return headers. The whole apparatus is situated between the cylinder banks at the end remote from the fly-wheel. The spiral tubes are cooled by air circulated by a cast metal fan driven from the crankshaft by a V belt. A sheet metal casing lined with asbestos surrounds the fan and cooling elements and prevents heat radiated from the engine and exhaust manifolds reaching them. The Auto-Klean filter for the lubricating oil is mounted on the governor side of the engine. It is coupled to the speed-setting device so that it is turned automatically and needs no attention from the driver.

Cooling of the circulating water will be effected in a radiator of the usual Reichsbahn pattern when the engine is installed in a railcar. The engine has a single-stage centrifugal pump driven by spiral gears. The sealing of the water space is effected by a loose Novotext sleeve pressed against the impeller by a chromium-plated sleeve. The cooling water supply header for each cylinder bank is a cast-in steel pipe, and the entrances to the jackets are bored to ensure equal distribution of water. Water leaving the cylinders is led to an overhead tank, and provision is made for draining the whole cooling system in frosty weather.

Starting of the engine is done by a rod connection from the driving position, but the speed regulation is carried out by means of a Siemens electrical speed-setter which is mounted on a bracket at the flywheel end and transmits the control shaft motion along the engine to a worm wheel drive. This drive has a ratio of 1:12, which is necessitated because of the high ratio between the speed-setter and the adjusting mechanism. On the opposite side of the shaft is a double lever, the ends of which are connected respectively to the speed adjustment of the governor and the ratchet of the lubricating oil filter. The engine is stopped by a Siemens magnet mounted on the governor side of the engine and connected by a rod to the governor shaft of the fuel injection pump. In order to stop the engine automatically in the event of a drop in the lubricating oil pressure an electrical controller is fitted which excites the stopping magnet, but to provide for starting there is a relay fitted which puts the stopping magnet out of action until the normal pressure has been built up. No starting magnet is required to lift the Deutz fuel pump plungers, for a return spring returns the regulator rod to full admission after stopping.



End view of Deutz 360 b.h.p. railcar engine

DIESEL ENGINE USERS ASSOCIATION.—The annual dinner of this institution will be held at Pagani's Restaurant, Great Portland Street, London, W.1, at 7.15 p.m. on March 18.

HUNGARIAN PRIVATE DIESEL.—One of the standard Ganz double-bogie 275 b.h.p. diesel-mechanical railcars has been fitted up with sleeping, dining, and lounge rooms and presented to the Hungarian Prime Minister for use on his tours through the country. The luxurious appointments have increased the car weight by 10 tons. Alfol insulation is fitted to the side panels.

ORDERS FOR FOWLER DIESELS.—Orders have been placed with John Fowler & Co. (Leeds) Ltd. for the following diesel locomotives: One 42 b.h.p. 0-4-0 for the South Wales Transport Co. Ltd., to work over the Mumbles Railway; one 80 b.h.p. 0-4-0 for Associated Portland Cement Manufacturers Limited, for Dunstable quarries; three 40 b.h.p. 0-4-0's for the South Essex Waterworks Company.

THE SANTA FE 3,600 B.H.P. LOCOMOTIVE

IN the second half of last year the 3,600 b.h.p. double-unit diesel-electric locomotive of the Atchison Topeka & Santa Fé Railroad was widely reported as having reached well over 100 m.p.h. As there is a tendency to accept reported 100 m.p.h. achievements without much authentication, we asked the owning railroad to confirm these reports. In his reply, Mr. S. T. Bledsoe, the President, says: "On a trip to the Pacific coast in September with a trailing load of nine cars, or 738 (short) tons, a speed of 95 to 111 m.p.h. was maintained for nine miles on a 1 per cent. descending grade near Piute, California. On a second trip to the Pacific coast early in October with a trailing load of 9 cars, or 771 (short) tons, the highest speed was 106 m.p.h. on a 1 per cent. descending grade near Cadiz, California. Returning with the same train a maximum speed of 102 m.p.h. was attained on a 0·46 per cent. descending grade. On the westbound trip a speed of 100 m.p.h. was equalled or exceeded eight times, and on the eastbound trip three times."

There have been three major test runs with this locomotive. On the first, made late in September, there was no thought of following any unusually fast schedule on the journey from Chicago to Los Angeles and back, and numerous stops were made on grades and elsewhere for brake and acceleration tests. It was on this run that 111 m.p.h. was reached. On the second run the train left Chicago on October 13 and reached Los Angeles the next day; the total time was 41 hr. 7 min. for the 2,230 miles. The return trip began on October 16 and occupied only 39 hr. 35 min., an average of 56·3 m.p.h. Faster averages were maintained on a more recent run, when the diesel, hauling an eight-car train containing 75 passengers, ran from Chicago to Gallup, New Mexico, in 1,511 min., the average speed for the 1,499 miles being 59·5 m.p.h. This journey included the crossing of the Raton and Glorieta mountain ranges. The distance of 992 miles from Chicago to La Junta, Colorado, was made in 14 hr. 56 min., at an average of 66·5 m.p.h. Speed on this run was not allowed to exceed 98 m.p.h.

It was on this run that the forward 1,800 b.h.p. unit of the locomotive caught fire at Gallup on November 20. The fire was easily put out, but a steam engine was requisitioned to pull the train on to Los Angeles. After a preliminary examination it was decided to allow the diesel locomotive to pull its train back to Chicago, and on arrival there it was taken to the works of the Electro-Motive Corporation, the builder, for proper investigation. Here it was determined that the fire was due to the combustion of vaporised fuel accidentally introduced into the engine room, but the actual means of ignition could not be determined. An excessive amount of fuel was transferred from special reserve tanks in the baggage car behind the locomotive to the fuel supply tanks in the engine room, and this excess overflowed through the vent pipes on to the roof and dropped into the engine room where it was vaporised and mixed with the air from the cooling fans. One of the two 900 b.h.p. Winton engines in the forward engine room was slightly damaged. No damage was suffered by the two main generators, but much of the auxiliary electric equipment and control apparatus was destroyed, and the side sheets and cross panels of the body were affected. In normal service, such a mishap would not occur, as the provision of the supplementary tank in the train was necessitated because at that date the intermediate fuel supply points were not in operation.

Additional to the information given in our issue of October 4, 1935, it may be mentioned that this locomotive has a starting tractive effort of 120,000 lb., and a value of 19,000 lb. at 60 m.p.h. The electrical transmission equipment consists of four main generators and eight traction motors. The bogies have 36-in. wheels spread over a base of 8 ft. 6 in., and are pitched at 40 ft. centres. Each double-bogie half of the locomotive has an underframe of the Commonwealth one-piece steel casting type.

MORE HIGH-SPEED TRAINS FOR DENMARK

AS a result of the success of the three-car 1,100 b.h.p. *Lyntog*, set to work between Copenhagen, Aarhus and Esbjerg on May 15, 1935, the Danish State Railways has ordered four further trains of a generally similar type, but made up of four cars instead of three.

These four cars will be divided into two two-car units each supported on three bogies. At each end of the train there will be a driving compartment and an engine room. Adjacent to one engine room will be a restaurant and buffet with a seating capacity of 16, and next to the other engine compartment will be the luggage room. Both will be separated from the adjoining engine room by a double sound-resisting panel. The luggage compartment is to have polished side and end panels so that if necessary it can be converted into a restaurant with the minimum of trouble.

One of the centre cars will contain seven first-class compartments, with six seats in each, and one general class compartment with eight seats. The other three cars will be of the centre corridor type with two seats on each side of the gangway. In the first class compartments the seats will be upholstered with covers in bright colours, and the seats in the general class compartments will be upholstered in blue leather, with high backs, arm and head rests, and window tables. The walls will be covered with panels of bright birch. In each of the cars there will be a small wardrobe for overcoats and hats. Each train will contain 42 first class seats and 180 of general class. In one of the trains, however, the layout will be of a somewhat different type. In this train there will be seven first class compartments in each of the centre cars, and the rest will be of the general class. This train will then have 84 first class seats and 120 general class. The doors will be of the sliding type and will be closed by the guard by compressed air with push button control.

The total engine power of 1,100 b.h.p. installed in the *Lyntog* has been deemed sufficient for these new and heavier trains, but the four 275 b.h.p. engines of the 1935 trains have been given up in favour of two 550 b.h.p. engines as used in M0 class single railcars set to work in October last (see *Diesel Railway Traction Supplement* for November, 1935). It is expected that the new trains will be ready in time for the inauguration of the summer timetables on May 15, 1937, and they will be used on the same routes as the *Lyntog*, but will start from Jutland in the morning and return in the evening.

NOTES AND NEWS

New German Diesel Services.—The Reichsbahn has introduced services worked by diesel railcars on the Munich-Kaufering ; Munich-Kempten ; Kaufering-Buchloe ; and Buchloe-Kempten lines in southern Bavaria.

Metallurgical Laboratory.—High Duty Alloys Limited, the makers of Hiduminium and other magnesium and aluminium alloys, has added a metallurgical and chemical laboratory to its works at Slough.

Algerian Diesels.—Two 720 b.h.p. diesel-electric locomotives are being built by the Forges & Acieries de la Marine et d'Homecourt for hauling mineral trains on the metre-gauge lines of the Cie des Phosphates de Constantine.

Fuel Pump Works.—Simms Motor Units Limited, the maker of the Simms Uniflow fuel pump for oil engines, is extending its East Finchley works to meet the increased demand for fuel pumps and components.

New Argentine Diesel Service.—After trials between La Plata and Samborombon, the four new 270 b.h.p. diesel-electric cars built by Sulzer, and described in the issue of this Supplement for October 4, 1935, have been set to work Buenos Aires (Avellaneda) and La Plata. The 33·5 miles are scheduled to be covered in 52 minutes.

Small Spanish Diesel.—A 90 b.h.p. Deutz-engined shunting locomotive has been built for the Corunna port authorities by the C.A.F. Beasain. It has Brown-Boveri electric transmission, with a 51 kW. main generator and a 45 kW. traction motor. It weighs 20 tons and exerts tractive efforts of 11,500 lb. at starting and 4,400 lb. at 4½ m.p.h. The top speed is 10 m.p.h.

Dutch Diesels.—In our December 27 issue we mentioned that 15 of the 35 Maybach-engined triple-car trains had been put back into service and since May 15, 1935, had been making an aggregate monthly mileage of 62,000. As from February 3, this mileage has been increased to 93,000 by the reintroduction of further sets, and it is anticipated that a further increase to 108,000 miles a month will be possible before long.

Railcar Paper.—Under the auspices of the Institution of Automobile Engineers, a joint meeting of ten technical societies will be held in the Royal Geographical Society's Hall, Kensington Gore, at 7 p.m. on March 3, to hear and discuss four related papers by Mr. H. D. Bush, of Wm. Beardmore Limited ; Mr. C. J. H. Trutch, of Sir W. G. Armstrong-Whitworth & Co. (Engineers) Ltd. ; Mr. Julian Tritton, of Messrs. Rendel, Palmer & Tritton ; and Major W. G. Wilson, of the Self-Changing Gear Trading Co. Ltd.

G.W.R. Diesel Services.—Supplementary services over a number of routes have been provided by the G.W.R. since the first of the new diesel cars was received from the A.E.C. On February 3 new diesel trains were inaugurated between Oxford and Princes Risborough, Oxford and Banbury, Oxford and Witney, Oxford and Didcot, and Didcot and Swindon. The Great Western now operates no fewer than 70 diesel trains daily from Monday to Friday. On February 17 services were begun between Bristol and Weymouth (two in each direction daily) ; Westbury and Salisbury ; and Yeovil and Taunton.

Flogging a Dead Horse ?—Once again it is stated that the Commonwealth Railways are considering the use of diesel stock on the trans-continental section of 1,050 miles from Fort Augustus to Kalgoorlie. Designs and estimates for high-power diesel locomotives were submitted by a British firm in 1914, and several times since the war the project has been revived. Yet nothing has been done, although this long desert stretch is so eminently suited to diesel traction that large savings in gross operating costs are axiomatic, even if the units employed merely fulfilled old Beyer's remark of " Ach ! Anything will for a locomotive do."

Paris Suburban Rakes.—The Northern Railway of France has budgeted a sum of 8,000,000 fr. to cover the proposed provision of four triple-car diesel trains for operation on fast suburban services out of Paris. Each rake will have two 400 b.h.p. engines and will be generally similar to the two sets now operating an express service between Paris, Lille, and Tourcoing, and the further express sets under construction. It is probable that two of these new suburban rakes will be coupled together in multiple-unit and divided at some convenient junction in order to serve diverging lines. The Nord budget contains an additional allowance of 1,000,000 fr. for spare parts, which apparently will cover also the units now at work and under construction.

Union Pacific Trains.—It is reported that the Union Pacific Railroad also has ordered some streamlined trains for the Chicago-Denver service to run in the same time over a route nine miles longer than that of the Burlington line. It is possible that these are the two 11-car trains, one of 2,100 b.h.p. and the other of 2,400 b.h.p., which have been under construction for the Union Pacific for the past twelve months, and which were intended to go into service between Chicago and California in April.

First Australian-Built Diesel.—A six-coupled 10-ton diesel-geared locomotive has been built by G. W. Kelly and Lewis Proprietary Limited, of Melbourne, for the haulage of timber over the 15-mile Rubicon tramway. The locomotive is powered by a Dorman-Ricardo engine developing a maximum of 72 b.h.p. at 2,000 r.p.m., but normally governed to 62 b.h.p. at 1,550 r.p.m. The four-step Wilson epicyclic gearbox gives road speeds of 2¾, 5, 8¼, and 13½ m.p.h. and is driven by the engine through a Vulcan-Sinclair hydraulic coupling. A load of 48 tons has been hauled up the maximum grade of 1 in 30, and 80 tons is normally pulled up two 1 in 52 grades. The elimination of farm and forest fires was one of the main reasons for the choice of a diesel locomotive.

Zephyr Traffic.—The four Zephyr trains on the Chicago, Burlington & Quincy Railroad had covered almost 700,000 miles up to the end of 1935, the individual mileages and dates of going into service being as follow :

	Miles.
Burlington Zephyr (November, 1934)	234,500
Twin Zephyr, No. 9901 (April, 1935)	215,975
Twin Zephyr, No. 9902 (April, 1935)	210,803
Mark Twain (October, 1935)	37,732
Total	613,010

Over a full twelve-month period the original Zephyr, operating between Kansas City, Omaha, and Lincoln, was out of service eleven days, made up of two for various mechanical adjustments ; four days for replacement of the wheels ; three days to insert a fourth car in the rake ; and two days for the installation of auxiliary air-conditioning. The number of passengers carried by this one train was 74,390, and the average journey length was 114 miles. A questionnaire answered by the passengers showed that 16 per cent. would have used other forms of transport if the Zephyr service had not been available, and on this basis the railroad computes an addition of $11,500 to its revenue.